TOOLING & PRODUCTION Magazine

MARCH 1959

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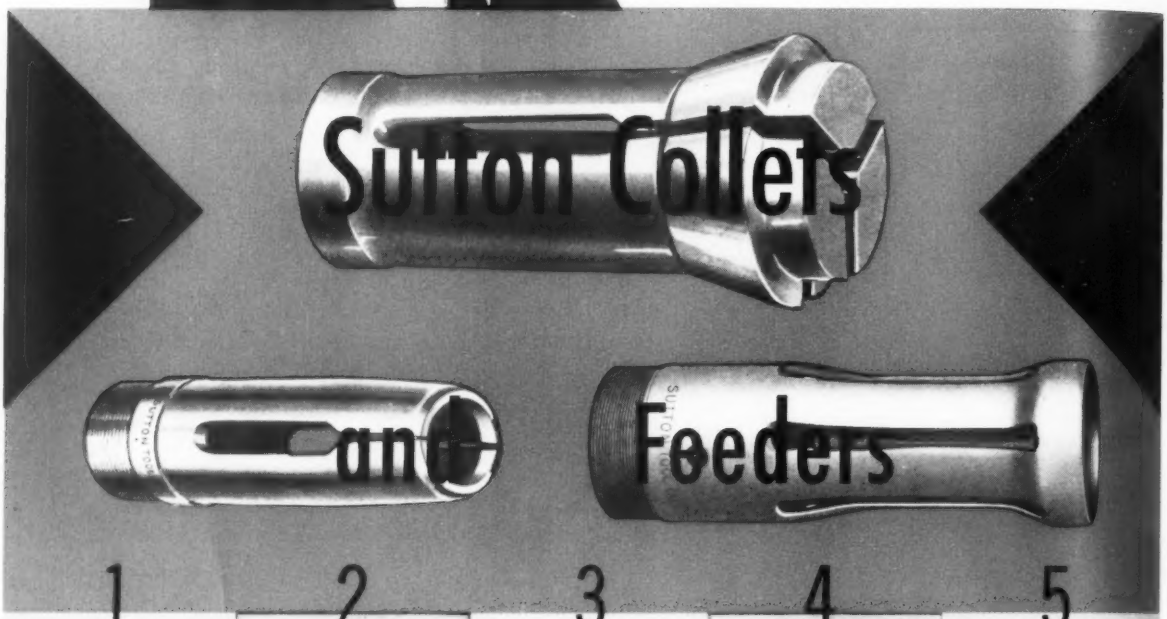
why our company specifies –



1

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TP-3

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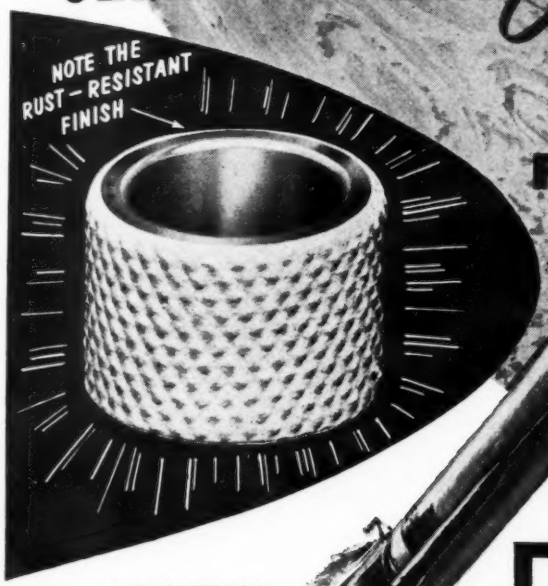
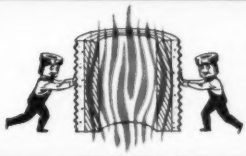
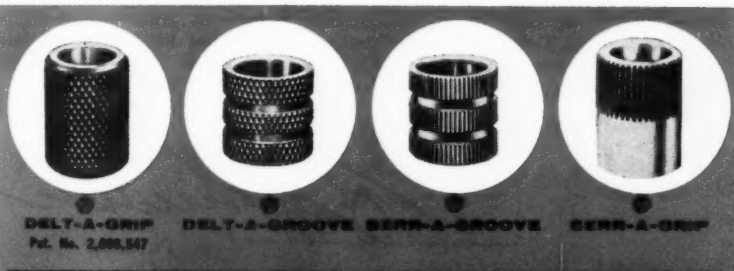


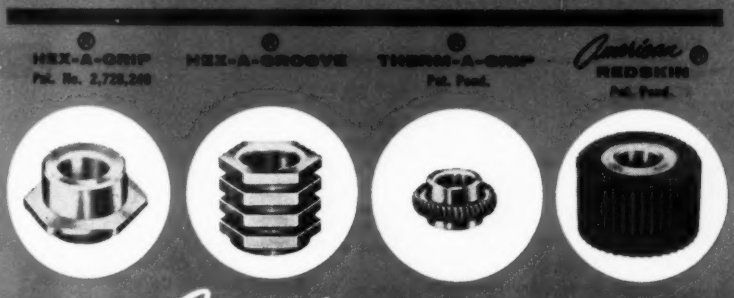
CERAMICS — used as a barrier against the tremendously high temperatures encountered by the nose cones on ballistic rockets, has been adapted by the American Drill Bushing Co. to a line of precision drill bushings for use in plastic tooling. The Ceram-A-Grip bushing gives a maximum of protection against bushing misalignment and spin out, with a minimum sacrifice of close hole spacing.

EXCITING new development from the Space Age Laboratories



DO YOU HAVE A FRICTIONAL HEAT PROBLEM? THE THIN CERAMIC SHELL PROVIDES AN EFFECTIVE HEAT BARRIER! CERAMIC MATERIAL FUSED TO THE OUTER SURFACE OF THE PRECISION DRILL BUSHING EFFECTIVELY INSULATES THE PLASTIC POTTING MATERIAL FROM ANY EXCESS FRICTIONAL HEAT BUILD-UP IN THE BUSHING.





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CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

MARCH 1959
VOL. XXIV No. 12
GEORGE J. HUEBNER, Founder
1885 - 1956

PERSONALLY SPEAKING

Dear T & P Reader:

Several especially interesting items are worthy of comment this month. One is the start in this issue of a series of articles entitled "Heat Treating Today." These articles will be addressed basically to plant operating men, although they will have much import also for metallurgists and management. We believe you will want to make a point of having a number of your associates read the whole series. Probably you will want to clip them all. Try the one in this issue and see.

Also in this issue is an article on patent English which we expect will be only the first of a number of articles we'll present on the general subject of patents. These patent articles are sparked by your very large and emphatic affirmative replies to Editor E. W. Pennington's editorial in the November 1958 issue.

A couple of weeks ago I had the opportunity of making a considerable number of personal calls in the Boston-Worcester-Providence area of New England. Everywhere I went I found definite improvement in business although that is not what I want to comment on. Of special interest was one call made at Newton Hydraulic Tooling Company. This company has developed a line of standardized components, consisting of hydraulic cylinders and hand-operated pumps, for holding anything in a jig or fixture. According to Gerald P. Wellman, Newton's Sales Manager, the pumps are capable of handling from a few up to as many as a hundred or more cylinders, making possible positive securing of a work piece through only a couple of strokes of a pump. The new line looks like it has lots of applications. There's a very good template-type catalog available.

Incidentally, machine tool sales are picking up noticeably. I visited George Hawkins at Brown & Sharpe in Providence and he pointed out a number of spaces in the Precision Center, formerly filled by machines which had to be used to make customer deliveries. Also, I found on a visit with Floyd Dodge of Wade Tool Company that his company's business has never been better. In case you don't know, Wade Tool makes small precision tool room and production turning machines.

Cordially yours,

Ray Huebner

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WHERE QUALITY CONTROLS

EXECUTIVE DEVELOPMENT PREREQUISITES

by Donald H. Sunderlin
Managing Partner
SUNDERLIN ORGANIZATION
Cleveland, Ohio

THE DESIRABILITY OF A PROGRAM for developing executives becomes startlingly apparent when an unexpected vacancy occurs. The sudden death of a vice president, or his acceptance of another position, creates a large void unless a well trained replacement is available. The alternatives are to hire a good executive who may not be familiar with the industry, or to promote a man who is not entirely qualified for the job. Either alternative is costly in terms of deferred potential profits and administrative instability.

Of equal, though less obvious, significance in these respects is the misplaced executive who does not know how to manage and is not fitted by nature to become a leader. Unfortunately, the mere passage of time does not solve this man's problems or those of an unqualified man who has been promoted. Either one gains a clearer understanding of the details of the job but makes little progress in becoming a better manager of people—the distinguishing mark of an executive.

When an unqualified executive is promoted to fill an unexpected vacancy or a key man's performance is mediocre, the factors in the problem are the same: What it is desired to accomplish must become crystal clear and the talents of the executive holding the job must be broadened.

The General Sales Manager resigned in one case, and took the same kind of job with a strong competitor. Because the product line was in a highly specialized field, Management decided to promote the Assistant Sales Manager instead of stealing a man from a competitor.

. . . **Continued on page 8**

CIRCLE INFORM-A-GRAM KEY NO. 6

SPRING STRESSES that formerly required premium-priced materials can now be handled by Duraflex,® which costs no more than regular phosphor bronze. Write for literature and samples, today.

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August 1, 1958

The American Brass Company
414 Meadow Street
Waterbury, Connecticut

Gentlemen,

SUMMARY OF ENGINEERING LABORATORY REPORT No. 8158

SUBJECT: Fatigue Life and Endurance Limit testing of; "DURAFLEX" Superfine-Grain Phosphor Bronze and Commercial Quality Phosphor Bronze, 5% (A) spring quality strip material.

SPRINGS: Flat spring strip was made into the usual type of contact springs used in switches, relays and instruments. These springs were deflected at about 1 cycle per second in a specially built fatigue testing machine and the deflections recorded.

STRESSES: The springs were deflected from the initial free position of zero stress to a final position having a bending stress of 77,000 p.s.i.

This stress, for phosphor bronze strip is unusually high and is higher than stresses ordinarily recommended for Beryllium-Copper or Stainless Steel for such severe service.

RESULTS: Commercial Quality Phosphor Bronze, 5% (A) springs acquired a permanent set quite early and broke at an average number of deflections of 453,374.

"DURAFLEX" springs were still satisfactory, showed no permanent set, no loss of load and no breakage at 4,000,000 deflections.

CONCLUSION: Design stresses for "DURAFLEX" can be at least 50% higher than the stresses for Commercial Quality Phosphor Bronze, 5% (A) as shown in the TOOL ENGINEERS HANDBOOK.

Respectfully submitted,

THE CARLSON COMPANY

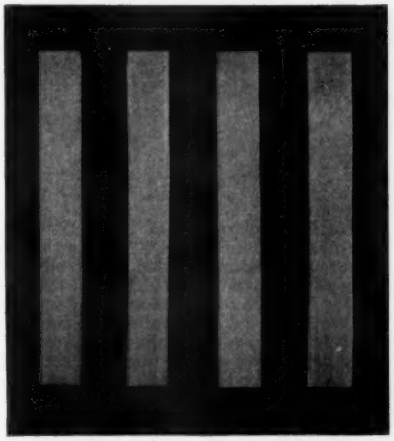
Harold Carlson

Harold C. R. Carlson, P.E.
Licensed Professional Engineer

LICENSED PROFESSIONAL ENGINEER HAROLD C. R. CARLSON No. 25571 STATE OF NEW YORK

HC:R

THREE SPRINGS of regular Phosphor Bronze, 5% (A), actual size, took a permanent set at about 200,000 deflections and fractured at an average of 453,374 deflections.



FOUR SPRINGS of Duraflex Superfine-Grain Phosphor Bronze, 5% (A) were still satisfactory after 4,000,000 deflections.

DURAFLEX, available in Phosphor Bronzes (A), (C) and (D), in strip and wire, offers a host of opportunities to cut costs while maintaining or improving quality and performance. For further information and technical help to select the alloy to meet your needs—call in your American Brass Company representative, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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CIRCLE INFORM-A-GRAM KEY NO. 7

. . . Month's Talk from page 6

The Assistant Sales Manager was a good personal salesman but he hadn't the foggiest notion of how to manage a sales department.

Management frequently has the alternative of filling the job as it existed, or raising the objectives to achieve a better result. In either case the incumbent's capabilities must be brought to a higher level.

Learning What Training Is Needed

Before the right kind of training can be evolved, certain basic considerations must become known: Exactly what are the objectives of the job; what will be the status of the new man in the organization as regards his superior, his subordinates, membership on committees, and his line and staff relationships? Exactly how should he go about attaining his job objective; general duties, specific duties, and limits of responsibility? Finally, what knowledge is needed, to get the desired results, in terms of the job situation?

A detailed Job Description spells out the objective and the way by which is must be attained; exactly what is to be accomplished and how it is to be done.

Executive appraisal discloses the individual's strong and weak points. Much has been written about appraisal methods, and the value of some procedures, such as psychological testing, is controversial. Essentially, however, this kind of appraisal consists of successive screenings for:

- Demonstrated success in any position requiring leadership of the necessary order. This assures administrative ability or points out weaknesses.
- Knowledge of organization. This assures conformance to sound principles or indicates areas where understanding is needed.
- Occupational judgment. This assures behavior and decisions compatible with the position and equal to the seriousness of the problems to be encountered, or it reveals the bench marks needed to orient the individual's sense of values.
- Ability to assume the required responsibility. This assures capability in a specific situation or it points to the areas in which help is needed.
- Initiative. This assures that a way will be found, within policy limitations, to surmount perplexing difficulties, or that a routine type of situation is indicated.
- Potential for growth. This assures replacement when a vacancy occurs on a higher level or that the possibilities for advancement are definitely limited.

These are the valuable by-products of personnel appraisal: (1) An executive stock pile can be built up. With the appraisal data recorded on punched cards, the most likely candidate for a given set of circumstances can quickly be located. (2) A replacement chart can be prepared. (3) The kind of training needed by each individual becomes known and can then be planned and provided.

Development Aspects

In many respects the heart of executive training is changing the attitudes of managers, particularly in the profitable smaller companies. It is not generally realized that the type of personality which can start a business is not the type needed to make it most successful after the company has become well established. Some executives, for example, particularly in the smaller profitable companies:

. . . Continued on page 11

Feel that clean, burr-free edge;
it's sheared on a DI-ACRO SHEAR

"We hold tolerances of ± .002" with our Di-Acro Shear," reports Richard Hodges, foreman at Consolidated Electrodynamics Corp., Pasadena, Calif. Manufacturing precision electronic equipment, they work with a variety of sheet materials—fish paper, beryllium copper, phosphorous bronze, hot and cold rolled steel, aluminum, etc. "Parts must be burr-free—require no milling to assure a 'light-tight' fit."

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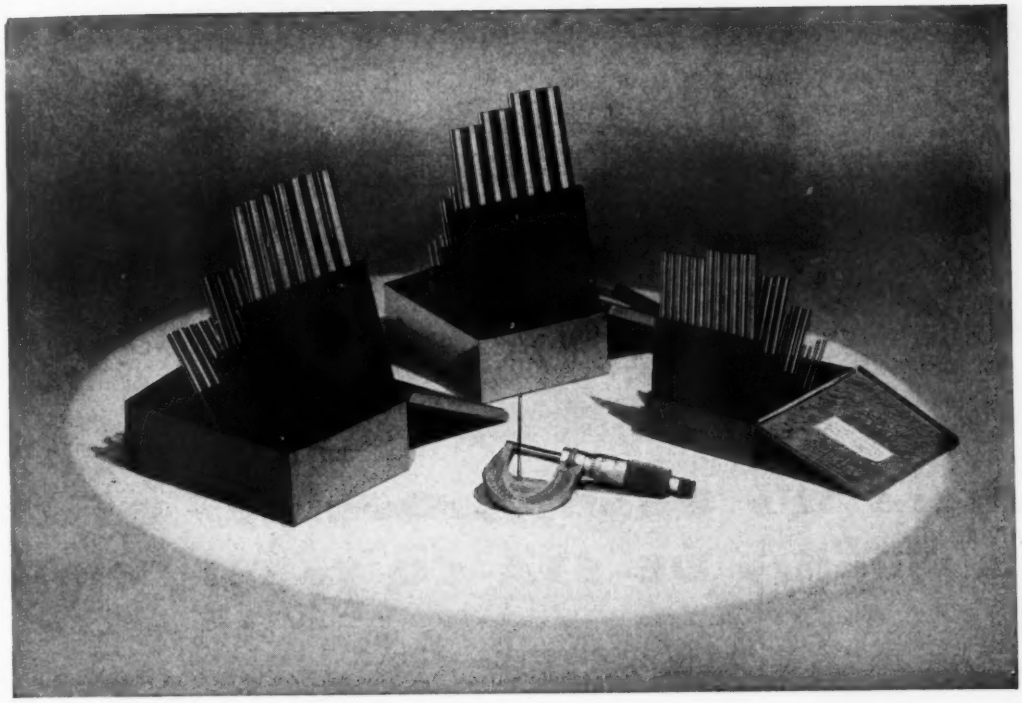

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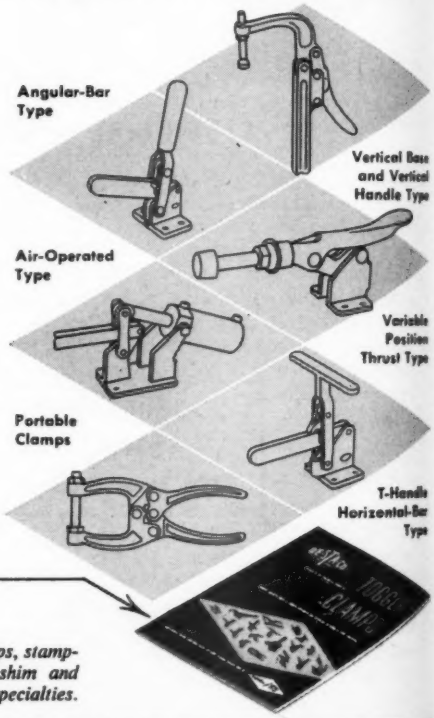
Our representative in your area is qualified and ready to serve you. Send for our 40 page catalog showing clamp applications, scale drawings and complete information.



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De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.

DETROIT STAMPING COMPANY

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. . . Month's Talk from page 8

- Are blinded by their success. This makes them complacent and deludes them into relying on expedience as a substitute for planned action.
- Are reluctant to delegate responsibility. Their team's productivity is therefore lessened.
- Are unaware of the necessity of following the chain of command. When the chain is violated, responsibility can be abrogated and morale suffers.
- Are confused as to the proper uses of line and staff functions. Indiscriminate scrambling of the two prevents either one from functioning effectively and nullifies the inherent advantages.
- Are inclined toward unconventional methods as a means of keeping informed. The existence of spies, hidden recorders, and infra red cameras does not long remain unknown and when they are discovered, everyone is suspicious and resentful.
- Emphasize the basic function they know best at the expense of other functions equally necessary. This causes an unbalanced organization which never is as profitable as it could be.

Up to this point vice presidents and executives on the upper echelons have been the subjects of this discussion. It would be a grave mistake to limit the application of the principles described to these men for the reason that every person who is responsible for others is an executive to some extent. Moreover, the leaders of tomorrow will come from this group.

Kinds of Training

On the foreman level, the emphasis should be placed on the kind of training that has a direct bearing on the everyday work of supervisors. Cost analysis, with proper direction, is an excellent way of giving the foremen broader knowledge of their jobs and the company.

An analysis of scrap loss could point to the need for preventive maintenance, inspection of raw material, process control of quality, and so forth. An investigation of lost time could disclose the need for better production planning, manning tables, more accurate cost accounting, a production schedule based on a sales forecast, and so forth.

As we go through the various levels of management the kind of training needed becomes more general. The emphasis changes to the development of understudies and their

. . . Continued on page 12

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Division of AMERICAN CAN COMPANY

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PERKINS PRESSES

were specially engineered to meet their specific requirements. Presses for Dixie Cup were constructed with additional die space and special feed rolls. As with all Perkins Presses, speed, accuracy, safety and long life are an integral part of every machine.

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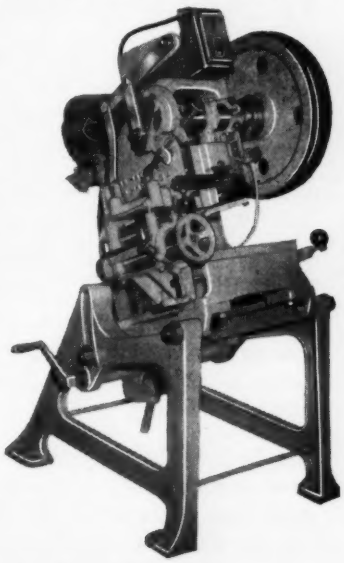

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MACHINE COMPANY
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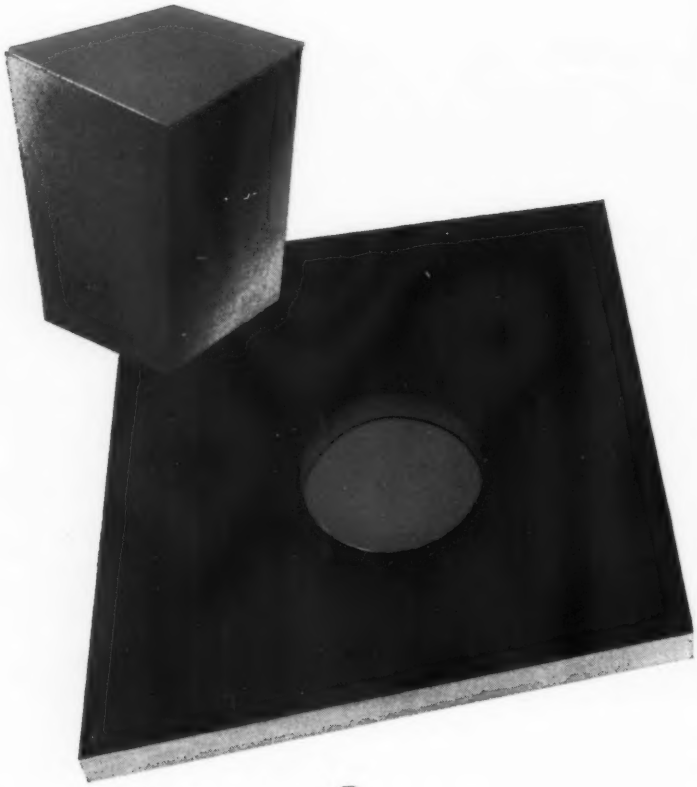


Inconsistency!

Does anyone expect perfect teamwork between a straight drill and a () barrelled out or a)(bell-mouthed drill guide? Of course not! That's as inconsistent as looking for close tolerance between a square peg and a round hole.

If your drilling operations demand maximum accuracy,
THINK FIRST OF ACE . . .
the proven superior precision drill guide.

There is an interesting "Inside Story" about Ace Drill Bushings. Because the walls, inside and out, are consistently || parallel, this greater drill bearing surface produces better work with longer life of both drill and bushing.

Ace Drill Bushings are made right . . . to wear right. They guarantee a maximum concentricity of .0003" t.i.r. . . . usually it is far less. You can depend upon ACE Drill Bushings. They are consistently **the best** in every way. **Always specify ACE!**

ACE DRILL BUSHINGS

NEW JERSEY
611 McCarter Highway
NEWARK 2
Mitchell 2-3006

HOME OFFICE
CALIFORNIA
5407 Fountain Ave.
LOS ANGELES 29
HOllywood 9-8253

MICHIGAN
10620 West Nine Mile Road
DETROIT 37
Lincoln 8-0777

CIRCLE INFORM-A-GRAM KEY NO. 12

. . . Month's Talk from page 11

training; how to cope with the problems created by big government, big unions, and regulations that circumscribe freedom of action. Attention then focuses on the objectives of the business and the policies by which all management decisions must be guided; the industry and the relationship to competitor's, for example.

Preparing to develop executives is not easy but, like so many other good management practices, it is less irksome and far less costly to do it than it is to leave it undone. The first step is to recognize the need and the second step is to formulate the kind of training needed by the particular individual or group in need of development.

LIFE-SIZE TOOLING TEMPLATES

This king size jig and fixture catalog includes 70 full size tracing templates. In addition to a great variety of milling fixture bases, box jigs and angle plates, the catalog constitutes

the first complete showing of a new line of aluminum "tumble" box jigs. The drawing templates are easily removable and are printed in red ink so the tool designer or draftsman can easily trace every line and dimension. Write for your copy to A. H. Stanton, Standard Parts Company, 1040 Broadway, Bedford, Ohio, or Circle Inform-A-Gram No. V1.

BUY
U.S. SAVINGS BONDS
TODAY!

is this the one best cutter for low cost MILLING?

We happen to know it is—on this specific job!

But frequently operators will rely on "pet cutters" for milling a variety of parts and materials. Result: Either higher costs or inferior finish . . . and usually both.

The problem has always been to match the cutter *exactly* to work and machine on every job.

Solutions to problems like these are our main product. And only after a penetrating study of machine, work, depth of cut, speed, feed rates and finish requirements do we recommend any cutter.

The inserted blade cutter pictured above is an example. On the work and the machine for which it was designed it is "the one *best* cutter for low cost milling."

We would welcome the opportunity to tell you more about this unique cutter selection service. Write:

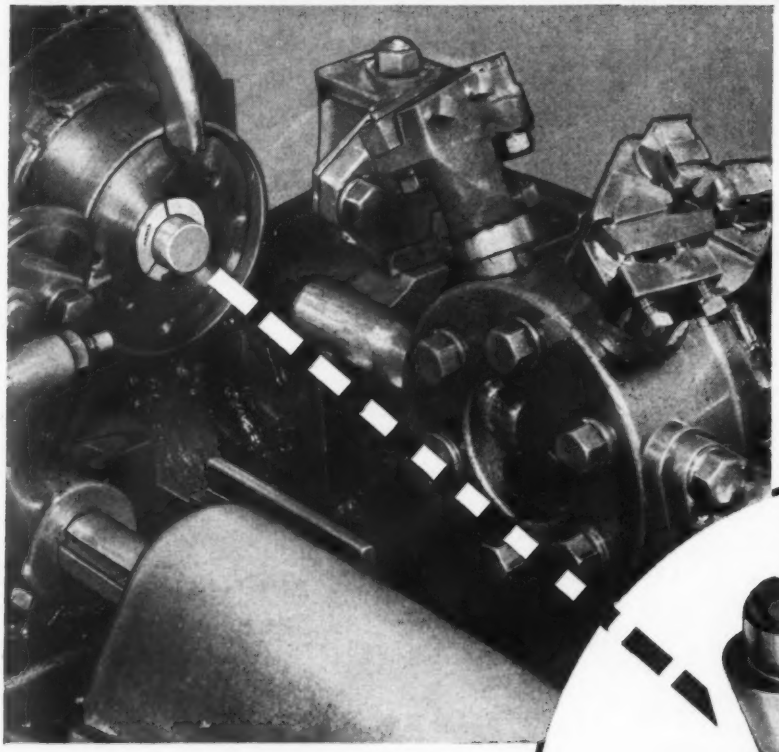
This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No 68H

THE
INGERSOLL
MILLING MACHINE COMPANY
CUTTER DIVISION
505 FULTON AVENUE • ROCKFORD, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 13

HARDINGE
ELMIRA, N.Y.

PRECISION PRODUCTS
for BROWN & SHARPE machines



COLLETS
FEED FINGERS
PADS

STOCK
DELIVERY
FROM

Elmira, Boston,
Atlanta, New York, Hartford,
Philadelphia, Rochester, N. Y., Dayton,
Detroit, Minneapolis, Chicago, St. Louis,
Oakland, Los Angeles, Toronto, Montreal

Order From **HARDINGE** Today

One Source of Supply Means Purchasing Economy

Write for FREE Bulletin B&S

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

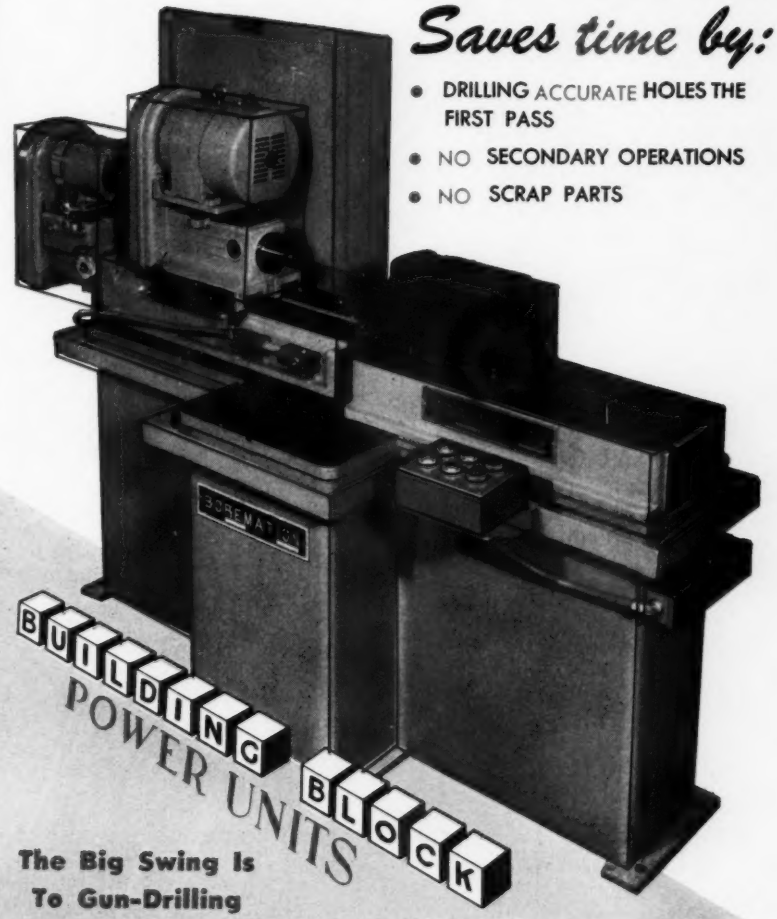
CIRCLE INFORM-A-GRAM KEY NO. 14

Why the Big Swing to Gun-Drilling ?

Because BOREMATION

GUN-BORING AND DRILLING

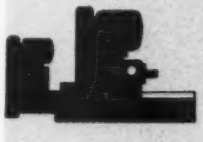
A constant High Pressure supply of coolant can be directed to the cutting edge of the tool by any one of our five High Pressure, High Velocity, "Building Block" Coolant Units.
Metal particles as small as 5 microns are eliminated by the "dual" BOREMATION filtration system built into the coolant units.



Saves time by:

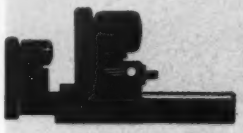
- DRILLING ACCURATE HOLES THE FIRST PASS
- NO SECONDARY OPERATIONS
- NO SCRAP PARTS

5 standard way type MODELS



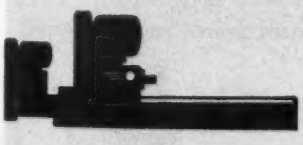
Model 1200
12" Stroke Hydraulic Feed

Model 1200-M
12" Stroke Mechanical Feed



Model 2400
24" Stroke Hydraulic Feed

Model 2400-M
24" Stroke Mechanical Feed



Model 3600
36" Stroke "Servo-System"

Up to 60" stroke available

The Big Swing Is To Gun-Drilling

Did you know that "Gun-Drilling" is the only successful method of deep-hole drilling or boring which can still maintain True Alignment with Close Tolerances and a High Grade Finish with one pass?

BOREMATION Gun-Boring and Drilling will cut your operating costs by eliminating secondary operations and costly scrap.

Sound impossible? Just check the multitude of necessary and extra features built into a standard BOREMATION Power Unit, and, you too will be convinced.

You too can be assured of accuracy that will save you: parts, time and money, when you switch to Gun-Boring or Drilling with a BOREMATION Power Unit.

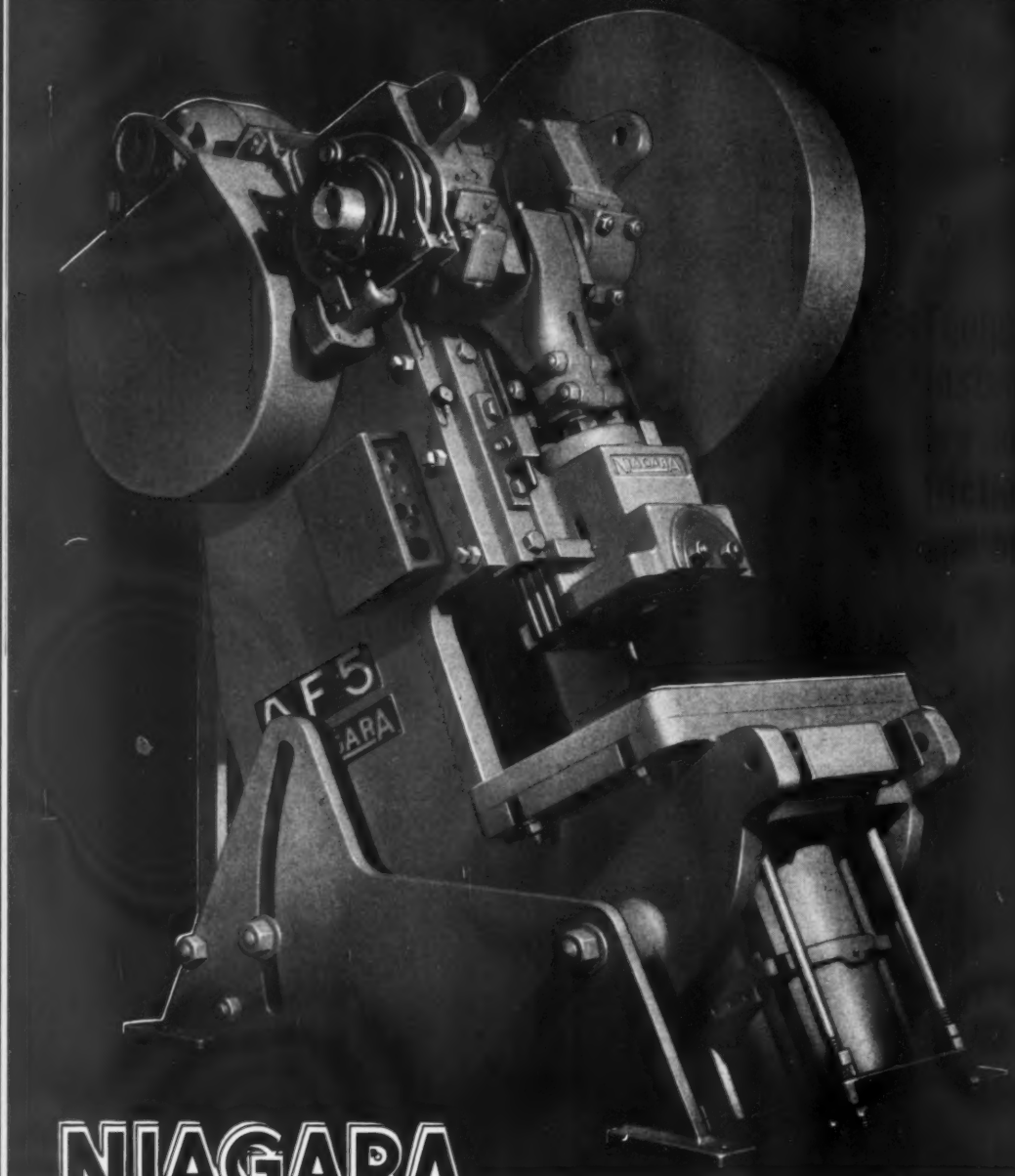
DRILLMATION CO. INC.

6500 E. ELEVEN MILE RD.
CENTERLINE, MICH. JEfferson 9-2030

BUILT TO J.I.C. AND N.M.T.B. STANDARDS

CIRCLE INFORM-A-GRAM KEY NO. 15

A GREAT NEW LINE* JOINS NIAGARA'S BIG OBI FAMILY



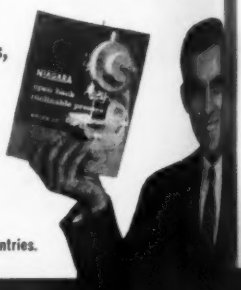
NIAGARA

Meet the new Series AF. Look it over . . . typical Niagara engineering from crown to base . . . every detail a benefit to you.

- Rugged, rigid frame for greater accuracy, longer die life.
- Unusually long, rigid slide of unique design prevents deflection of ways, solidly supports dies and extends their life.
- Exclusive multiple "V" gibbing for more guiding surface and greater resistance to off-center loads.
- Cool-running, long-wearing, pneumatic friction clutch and brake operate directly on the crankshaft . . . fewer parts to start and stop . . . faster engagement.
- Modern, rigidly supported gearing runs in sealed oil bath for long life.
- Simplified control for safer, time-conserving press operation.
- Patented one-man inclining mechanism.
- Full complement of accessories to meet your specific needs.

Look at the range: 14 sizes, geared and non-geared, shaft diameters 1¼" to 7½", capacities 5½ to 250 tons.
Niagara Machine and Tool Works, Buffalo 11, N. Y.

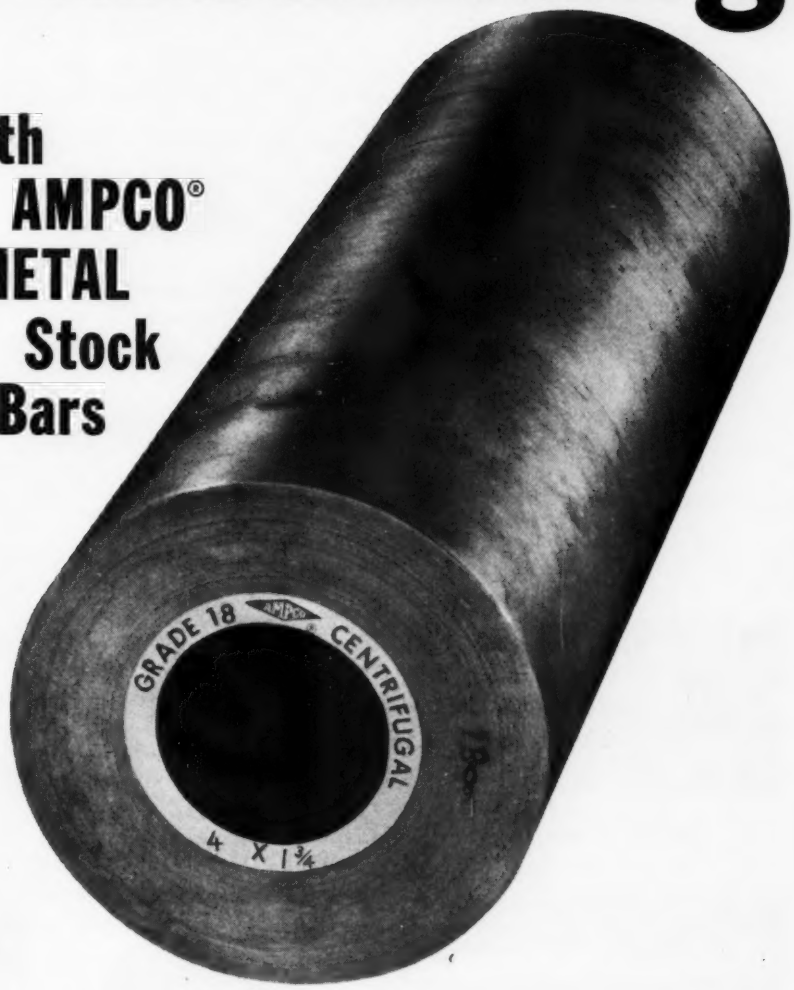
Now get the whole story . . .
Send for New Bulletin 55.

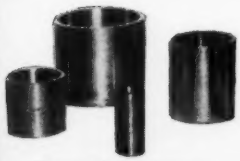


DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia / Distributors in principal U.S. Cities and major foreign countries.

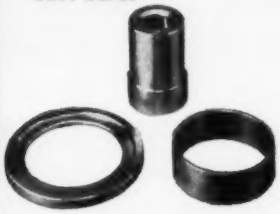
Save machining

with AMPCO® METAL Stock Bars





Typical bushings and bearings of Ampco Metal centrifugally-cast bars.



Only finish-machine cuts are needed on Ampco Metal Centrifugally Cast Stock Bars. They are semi-finish machined all over — finish allowance, 1/16" on O. D. and I. D.

Made of Ampco Metal Grade 18, a tough copper-base alloy that resists wear, shock, impact. Ideal for bearings, bushings, gears, and similar applications.

Your Ampco distributor has Ampco Metal Stock Bars in stock now — in 90 sizes up to 10" O. D. 12½" lengths. Call him for prompt delivery.

Ampco Metal, Inc., Dept. 54C, Milwaukee 46, Wis. West Coast plant: Burbank, Calif. — Southwest plant: Garland (Dallas County), Texas.

RM-11

AMPCO

AMPCO®

CIRCLE INFORM-A-GRAM KEY NO. 17

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON / HOLDERS

FOR END MILLS

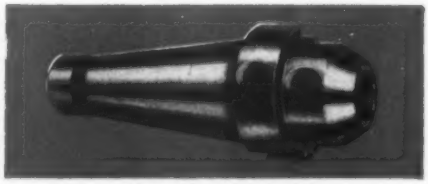
Regardless of the type or size of Straight Shank End Mills used the best results are obtained by the use of Weldon End Mill Holders and Adapters. They are manufactured of finest quality material to a high degree of accuracy to assure concentricity of the cutting tool together with maximum holding qualities.

Holders carried as stock items to serve end mill shank diameters 3/16" to 2" inclusive.

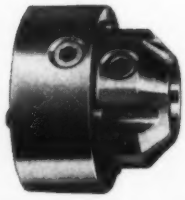
Weldon holders are used on all makes and types of milling machines and boring mills having National Standard Non-Sticking Tapers or the Brown & Sharpe or Morse type of tapers.

NATIONAL STANDARD TAPERS

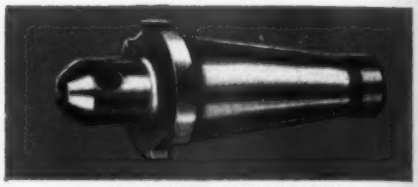
QUICK CHANGE ADAPTER AND HOLDERS



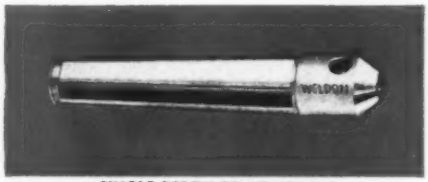
2-SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS



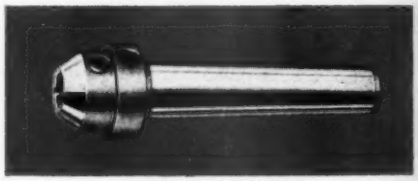
HOLDER WHICH DIRECTLY BOLTS ON STANDARD MILLING MACHINE SPINDLE. DRIVEN BY KEYS ON SPINDLE NOSE



SINGLE SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS



SINGLE SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS



2-SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS

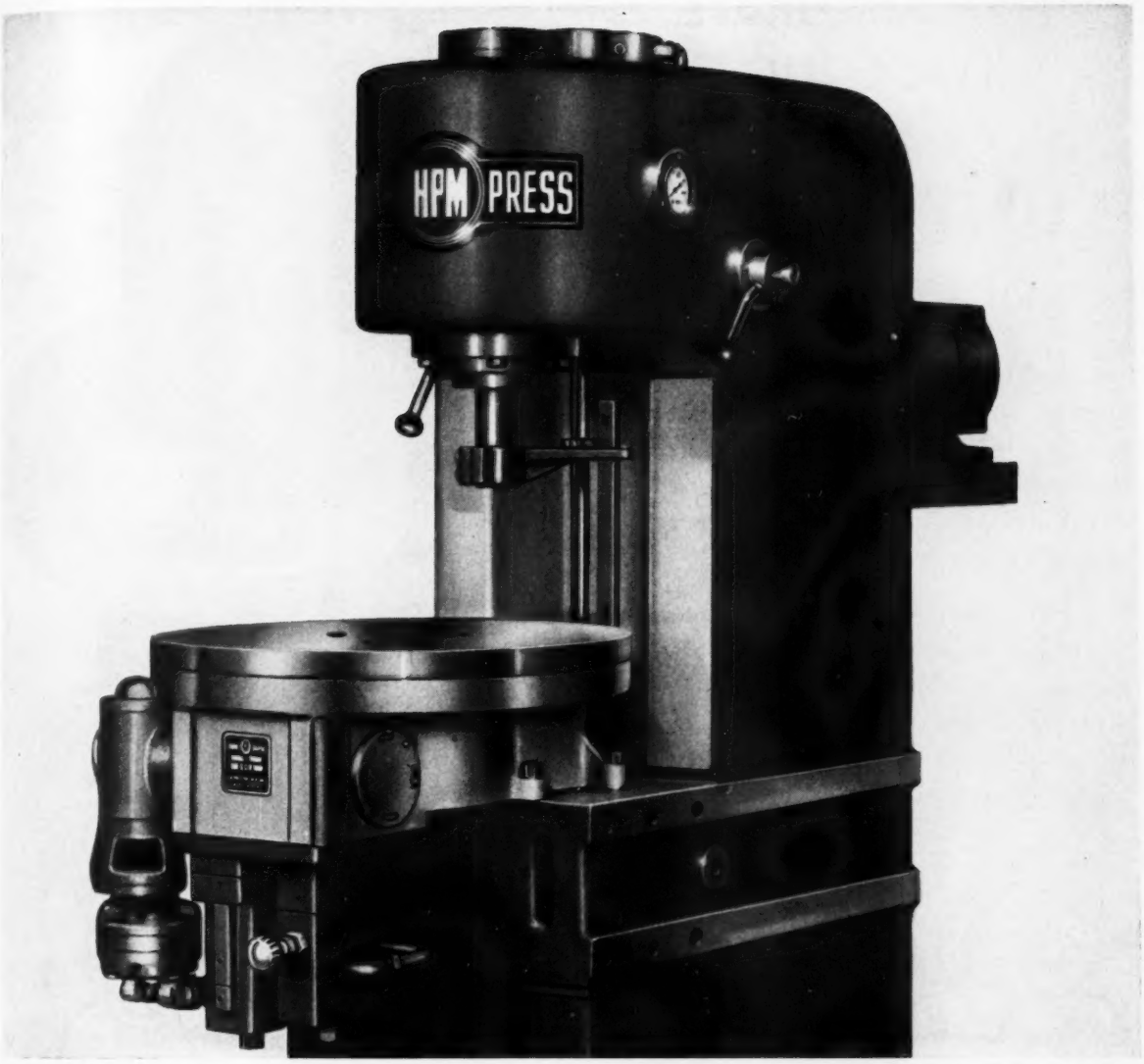
Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 18



INDEX TABLE SPEEDS TO 80 indexes per minute; carries tooling load up to 200 lbs.; 5, 10 and 15 ton models available; tables fit all press sizes.

GREATER PRODUCTIVITY FOR PRESS OPERATIONS

Greater productivity is the happy combination of good machine design and effective tooling. The new HPM C-Press, with index table, provides automatic machine operation with hydraulic power and refinements that aid tool engineers in many different ways. Here are three typical operations and what C-Press offers for each.

SPEED, CAPACITY AND CONTROL FOR AUTOMATIC ASSEMBLY

Completely adjustable for speed, tonnage and stroke; table has hollow spindle through which air, oil or electrical lines may be piped for assembly needs. Full 16" work circle for tooling on dial; high speed with high load carrying capacity; anti-friction bearings throughout. Accurate to .002" with sealed drive unit of barrel-cam design. Complete availability for automatic ejection; large machined mounting pads on sides and throat of press. *More to work with when tooling.*

SEALED DIAL IDEAL FOR BROACHING JOBS

Cutting oil cannot contaminate driving mechanism of the table as the table dial is sealed. Provision beneath the ram station for push-through broaching. Smooth, long, adjustable-speed stroke is ideal for small broaching jobs. Index table broaching increases production by eliminating waiting periods for loading and unloading fixtures. *More advantages for broaching with the C-Press.*

IDEAL CONTROL FOR FORMING AND COMPACTING

The C-Press provides variable speed and pressure adjustments for compacting loose materials. De-airing during compaction is simplified. Better density control with less laminating results. Metal drawing or forming uses same controlled speed and pressure characteristics for better metal flow, less fracture and improved appearance . . . *it's automatic.*

HPM

THE HYDRAULIC PRESS MFG. COMPANY

A Division of Koehring Company
Mount Gilead, Ohio, U.S.A. H 905

CIRCLE INFORM-A-GRAM KEY NO. 19

FOR ACCURATE LOCATING USE UNIVERSAL LOCATING PINS

Universal Locating Pins assure quick, accurate locating throughout even the longest production runs. They're hardened and ground to extremely close tolerances . . . precision made to give long service life for much less than the cost of ordinary tool-room pins.

Press fit, threaded or lock-screw types, round or relieved, are stocked in all standard sizes for immediate delivery. Write for catalog detailing locating pins plus other Universal production tools.

Relieved Press-Fit Pin

Threaded Pin

Lock Screw Pin

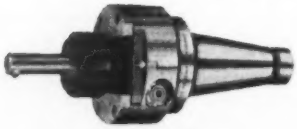
212

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

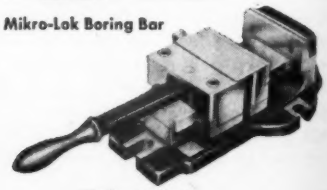
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 20

MANUFACTURING MEMOS

Don't Pass The Buck . . . "Our nation cannot prosper through a passive 'Let George Do It' attitude of indecision," says M. C. Patterson, general manager of Dodge Division, Chrysler Corp. Speaking recently at Taylor University, where he received an honorary Doctor of Law and Letters degree, he declared that everyone should take a more active interest in community affairs . . . Recent news from E. I. duPont de Nemours and Co. (Inc.), shows they're doing their share by awarding $1,200,000 to 139 universities and colleges. The nation will benefit from the fundamental research and strengthening of teaching provided by the program . . . In the same vein of more community awareness, Clarence O. Hamilton, executive vice president of Hamilton Cosco, Inc., recently went on record urging businessmen to become more interested in politics, and suggested they join a party, offer services to local political groups, know officials and activities, and encourage qualified people to participate in politics.

On The Level . . . A leveling off period for the material handling industry has been indicated by the findings of the industry's Institute. Their latest (November) bookings kept up with those of previous month, hinting that better times are ahead, comments L. West Shea, managing director of Materials Handling Institute. Sales may pick up slightly now, but major increases will not happen until later this year, he speculates.

Writing Guide . . . Procedures for presentation and preparation of papers for technical societies and trade associations are at your fingertips in the "Technical Societies Guide," published by the Industrial Publicity Assoc. Data includes membership structure and number, subjects of interest, policies on preprints and reprints, fundamentals of oral presentation, and visual aid tips. The 32-page guide is available for a small fee from the IPA Technical Societies Committee, Room 1616, 41 E. 42nd St., New York 17.

Here's A Switch . . . Many manufacturers in recent years have expanded into the defense business, but this trend is reversed by the United States Chemical Milling Corp., aircraft and missile subcontractor. They're coming down to earth to produce several thousand automatic coffee and hot chocolate vending machines. It's a $2,000,000 contract.

Epoxy Valve Castings . . . Reasonably stress-free cast valve models of epoxy resins, suitable for photoelectric analysis, have been developed by the Walworth Co.'s Research Division. The epoxies can be cast in any size or shape, and adhesive properties permit cementing pieces together to simulate welded prototypes or to facilitate making of models.

INDUSTRIAL DISTRIBUTORS SERVING INDUSTRY ECONOMICALLY THE RIGHT HAND OF PRODUCTION

SEE YOUR CAPEWELL DISTRIBUTOR

for
hand hack saws
power hack saws
hole saws
band saws
hammers
ground flat stock
and for quick
dependable service
on all your
industrial needs

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

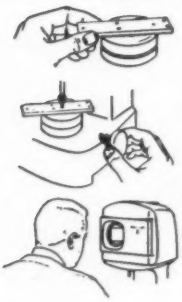
CIRCLE INFORM-A-GRAM KEY NO. 21

New! BAUSCH & LOMB DR-25 OPTICAL GAGE

Direct scale reading to .0001" ...

0" to 3" range...accurate to .000025"!

FAST, EASY AS A-B-C!



A Just set part to be measured on anvil . . . no masters or set gages needed. Large work table makes it easy to adapt special fixtures, accommodates widest variety of work.

B Turn knob to lower spindle . . . it will stop automatically on contact, with constant spindle pressure.

C See precise measurement at a glance . . . direct-reading scale is illuminated, magnified. No eyestrain, no conversion, no guesswork. Dependable measurement of depth, thickness, height, diameter, taper, angularity of surfaces, runout.

ONLY $695 COMPLETE

On-the-job demonstration! JUST MAIL THE COUPON TODAY!

Distributed in the U.S.A. through the DoALL Co.

BAUSCH & LOMB OPTICAL CO.
79839 St. Paul St., Rochester 2, N.Y.

☐ I'd like a free on-the-job demonstration of the new B&L DR-25 Optical Gage, with no obligation on my part.

☐ Please send Catalog D-285.

Name .....

Company ..... Title .....

Address .....

City ..... Zone ..... State .....

BAUSCH & LOMB SINCE 1853

MANUFACTURING MEMOS

Acquisitions

The line of precision surface grinders manufactured by the Abrasive Machine Tool Co. has been acquired by Landis Tool Co.

Hi-Precision Grinding, Inc., has purchased the patents and sales rights of Deltronic tenth plug gages and Micro-balls.

Merger

The Texas Instruments, Inc., and Metals & Controls Corp., have announced their merger under the heading of Metals & Controls Corp. C. J. Thomsen, former director and vice president of Texas Instruments, serves as president.

Expansions

Parker Hannifin Corp. has bought the former Kawneer Co. plant in Lexington, Ky. The 50,000 sq ft facility will be used to manufacture Parker's combination metal and rubber seals.

Warehousing operations in the Philadelphia and Chicago areas of the Cleveland Cap Screw Co. have been tripled. Larger quarters now permit fuller inventories and speedier service to customers.

New Handle

The metals division of Union Carbide Corp., recently got a new name. Union Carbide Metals Co. is easier to remember than Electro Metallurgical Co., and more closely identifies the division with the parent company.

Coming Events

March 11-13. Tenth Anniversary Spring Technical Meeting of The Pressed Metal Institute, Pick-Congress Hotel, Chicago.

March 16-20. American Society for Metals' 11th Western Metal Exposition and Congress, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles.

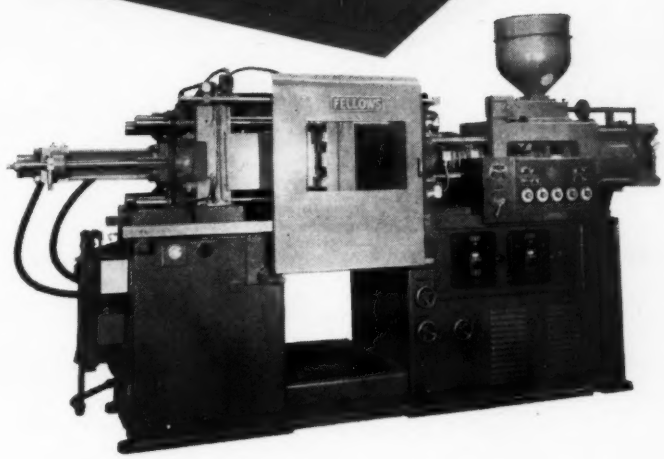
March 19-20. Society of Automotive Engineers' Production Meeting, Sheraton-Cadillac, Detroit.

March 26. Rochester Society for Quality Control's 15th Annual Quality Control Clinic, University of Rochester, Rochester, N. Y.

BUY U.S. SAVINGS BONDS TODAY!

CIRCLE INFORM-A-GRAM KEY NO. 22

As Automatic as you want!



FELLOWS 6-200 INJECTION MOLDING MACHINE

It's designed for versatility: attachments can be incorporated in the Fellows 6-200 to give you just the degree of automatic operation you need! A wide range of attachments permits full-automatic molding of many products that used to present problems, such as parts with internal and external threads, undercuts and side cores.

Whether you use it for partial or full-automatic molding, Fellows 6-200 pays off in increased production, fewer rejects, lower unit costs. Sensitive, dependable controls simplify set-ups and change-overs as well as operation, even on the most difficult jobs. You get dry-run speeds from 490 to 650 cycles per hour, shots up to 9 ounces with the optional pre-pack device.

Ask your Fellows representative for information about the cost-cutting Fellows 6-200 plastics injection molding machine, with or without optional attachments. (And ask him about the Fellows Plans that let you pay for your machine while it earns.) Just contact any Fellows office.

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich. • 150 West Pleasant Ave., Maywood, N.J. • 5835 West North Ave., Chicago 39
6214 West Manchester Avenue, Los Angeles 45

CIRCLE INFORM-A-GRAM KEY NO. 23

LATROBE Metalmasters . . .

working for you through BETTER High Alloy Die Steels

Fully-uniform
DESEGATIZED®
High Alloy Die Steels

- OLYMPIC FM
- BR-4 FM
- GSN FM
- COBALT CHROME FM

. . . for long-run dies!

Users of Latrobe's 12% chromium die steels pave the way toward greater production economy. Why? Because, as a result of Latrobe's exclusive DESEGATIZED® process, these steels are free of harmful carbide segregations —fully-uniform to insure maximum die results. Containing evenly-dispersed alloy sulphides, they are easier to machine . . . easier to work!

Put Latrobe Metalmasters to work on your long-run dies through using DESEGATIZED® High Alloy Die Steels . . . steels made by Metalmasters who *know* your production die requirements!

Call your Latrobe representative today!

LATROBE STEEL COMPANY

MAIN OFFICE and PLANT: **LATROBE, PENNSYLVANIA**

Branch Offices and Warehouses in Principal Cities

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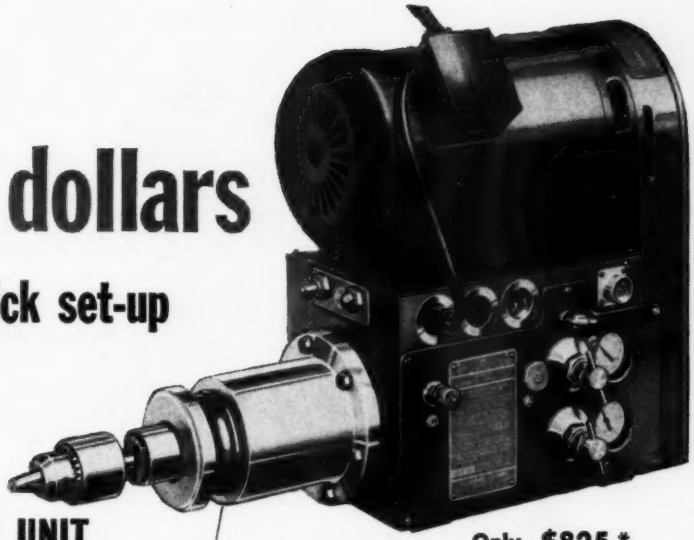
CIRCLE INFORM-A-GRAM KEY NO. 24

save tooling dollars

with this versatile, quick set-up

DUMORE®

AUTOMATIC "DRILL-N-TAP" UNIT



Only $825 *

Complete tool, ready to operate —includes reversing motor, electric tap control, pulleys, chuck.

Do all these operations—*and more*

TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DEBURR

NOSE MOUNTING BRACKET

Your Key to all-purpose machining—**anywhere.** It permits fast, easy mounting in any position, angle or direction in single set-ups, or multiple operations in sequence.

Plug it in and it's ready to go

—Any unskilled laborer can learn to operate it in minutes. Once set, it's always set — minimizes scrap loss, drill breakage and eliminates operator fatigue slowdowns. Changes easily, quickly from job to job, operation to operation, for long or short runs. Precision engineering, famous Dumore quality workmanship and separate, isolated hydraulic and pneumatic systems provide trouble-free service over millions of cycles. Less than one cubic inch of air required . . . a cost-cutting feature.

The Dumore Series 28 "Drill-N-Tap" Unit

can be a drilling or tapping machine with just the flip of a selection switch. Tap fits into chuck, no extra attachments required. Reversing motor controls tap, eliminates troublesome clutches. Adjustable, positive spindle speeds from 265 to 4900 rpm. Can be set up for operation in 5 minutes—on drill press or special machine, with simple nose bracket. *For more details, send coupon.*

You can save hundreds of dollars in first cost alone with these DUMORE AUTOMATIC DRILL UNITS

SERIES 24 DRILL UNIT
Fully automatic with all controls built-in for short or long runs and frequent changeovers. From $613*

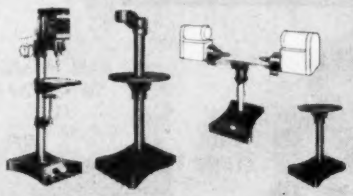
SERIES 26 DRILL UNIT
Same as Series 24 with just basic controls built-in for long, uninterrupted runs. From $505.50*

SERIES 20
Built-in adjustable controls—automatically selects proper speeds/feeds. No. 80 to 5/32" drill capacity. From $217.50*

*FOB Racine

BUILDING-BLOCK ACCESSORIES FOR AUTOMATIC PRODUCTION

MULTIPLE SPINDLE ATTACHMENT fits units 28, 24, 26. For simultaneous drilling or tapping of 2, 3 or 4 holes. Quickly adjustable center distances.



COMPLETE DRILL PRESSES AND TABLE FIXTURES
Includes Circular and Rectangular Fixture Presses, Cross Arm Bar Assemblies, Circular Production Tables, Variety of Brackets, Control Components and other units to provide complete parts needed for building your own single or multi-purpose drilling or tapping machines for lower cost production.

AND THESE HANDY, USEFUL TOOLS

DRILL GRINDER, resharpens and precision points drills up to ¼".

MICRO-DRILL for drilling holes as small as .0001" diameter, without skilled operators.

HI-SPEED DRILL PRESS, hand operated, bench type, 0-⅛" capacity. And, **DRILL SPEEDER,** right, fits standard drill press, 17,000 rpm. 0-⅛" capacity.

Sold and Serviced Thru Leading Industrial Distributors Everywhere

You Can Do More with **DUMORE**

ALL PURPOSE PRECISION METALWORKING TOOLS

VERSA-MIL • DRILL-N-TAP UNITS DRILLING UNITS • DRILL HEADS MICRO-DRILLS • DRILL GRINDERS PRECISION GRINDERS • HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES

THE DUMORE COMPANY • 1304 Seventeenth St. • Racine, Wisconsin

Clip to your letterhead

Send me Drill Unit details

Your Name_____

CIRCLE INFORM-A-GRAM KEY NO. 25

Only WESPO can supply ALL these WORK HOLDING DEVICES

TOGGLE CLAMPS and PLIERS 80 Types & Sizes
FIXTURE CLAMPS and LEAF JIGS Over 180 Types and Sizes
NEW HINGE CLAMP
BASE MOUNTED SWING CLAMP NEW
NEW "L" LOCK CLAMP
OVER 1000 TYPES & SIZES OF COMPONENTS
WRITE FOR FREE CATALOGS
Toggle Clamps

WEST POINT MFG. CO.
26935 W. 7 Mile Road • Detroit 19, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 26

MEN YOU SHOULD KNOW

Allen H. Jones has been elected vice president of sales and engineering of the W. W. Sly Mfg. Co. He now supervises the company's product improvement and new product development programs and is directing the expansion of the customer service program.

New director of engineering for the Cincinnati Division of Bendix Aviation Corp., is **Dr. C. E. Oelker.**

The Marvel-Schebler Division of Borg-Warner Corp. has appointed **Gordon Turnbull,** vice president and works manager; and **Frank Pilling,** vice president and general sales manager. Promotion of **Carl E. Ingels** to manager of manufacturing, and **Charles L. Catt,** to manager of production and material control at the Atkins Saw Division, was also made known.

Appointment of **H. E. Peterson** as supervisor of planning of the Dodge Assembly Plant, has been announced.

Harry E. Gravlin, Jr., has joined Hamilton Standard, division of United Aircraft Corp., as production manager, and is responsible for factory, purchasing, and production product operations. **Kevin J. O'Neill** is now serving as assistant plant engineer of the Norden Division in Stamford, Conn.

Oren W. Thompson's appointment as chief engineer was recently announced by The W. O. Barnes Co., Inc. He was previously plant engineer.

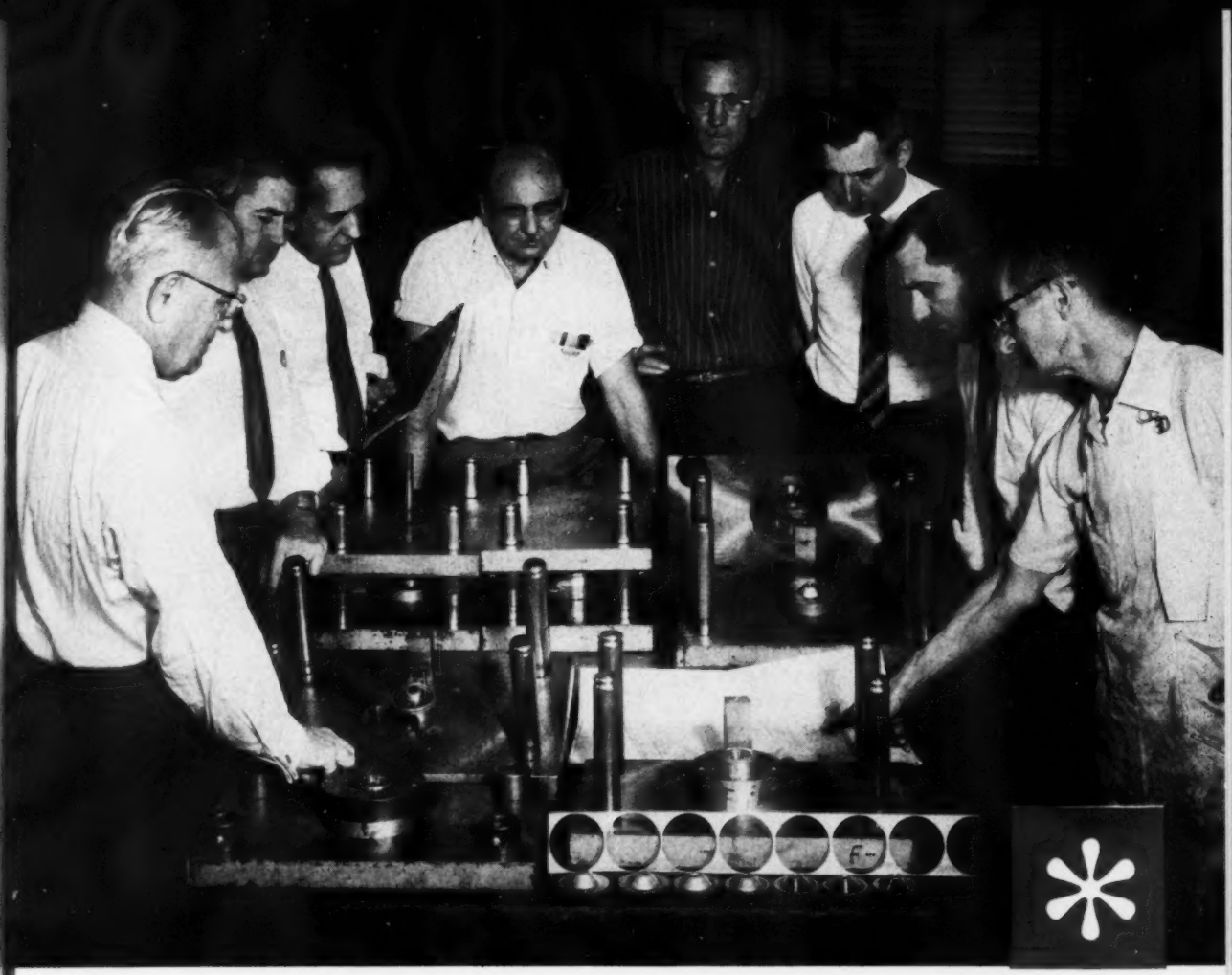
Newly elected executive vice president of The Cleveland Cap Screw Co., is **Thomas A. Fribley,** who is also a member of the board of directors and will retain the title and duties of secretary of the company.

The board of directors of The Torrington Co. elected **Walter C. Thompson,** chairman; **Milton E. Berglund,** president, succeeding Thompson; and **Rodney T. Dunlap,** executive vice president.

Serving in the newly created post of manufacturing vice president for Capitol Products Corp., is **George R. Metzdorf.** He's responsible for all manufacturing and manufacturing services in the country, including the Read Standard Division.

New vice persident and assistant to the president of Marquardt Aircraft Co., is **J. Louis Reynolds.**

... Continued on page 30



Do you know these tooling specialists?

If you don't, you should. On any tooling problem requiring high-precision gages, dies, jigs, fixtures or special machinery, they can save you time, money, headaches. They can keep you out of production jams... *or pull you out.*

These eight men* represent over 200 years of the choicest, most specialized tool-and-diemaking experience in America. Strong words? Well, consider these facts:

They direct what leading manufacturers in the electrical, appliance, automotive, ordnance and other industries acknowledge is the best-manned, best-equipped toolmaking facility on the Mississippi. Best-manned, because Ehrhardt has over 50 veteran tool-and-die makers and designers, many of them trained here. Best-equipped, because there isn't an important late-model precision machine tool or device (jig borers, jig grinders, profile grinding, electrical discharge equipment, etc.) which you won't find at Ehrhardt.

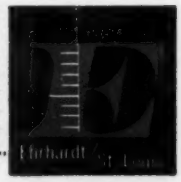
If you need close-tolerance work—whether it's a gage that takes 40 hours or less to produce or a complex lamination die requiring several thousand hours—you will be doing yourself a favor to get to know these men, to observe their skilled craftsmen and their unparalleled facilities.

You can do this by visiting the Ehrhardt plant, and you are cordially invited to do so. In the meantime, write for a copy of TRIPLE PLUS (the three plusses: "Precision Skills, Full-Range Facilities, Unique Experience"), a twenty-four page illustrated brochure which will convince you why knowing these tooling specialists can be worth your while.

Ehrhardt Tool & Machine Company

914 Monroe Street, St. Louis 6, Mo.

"A Nation-wide Service to the few who want the most in high precision gages, dies and fixtures."



*

EHRHARDT/ST. LOUIS PLANNING COMMITTEE—left to right: Willis G. Ehrhardt, president; Charles Hawkins, general manager; Bill F. Boyd, purchasing agent; Ed Humm, shop superintendent; Ed Deuser, shop foreman; Joe Poletti, chief tool designer; Bud Graser, sales engineer, and Tony Wieclaw, veteran tool and die maker.

CIRCLE INFORM-A-GRAM KEY NO. 27

Why The Mystery About Gage Materials?

Extensive testing by The Pipe Machinery Company in customers' plants has proven High Speed Steel the best material developed so far for use in gages. Pipe Machinery is now offering working plug gages, through 1½" diameter, of this superior metal at no extra charge.

Years of experience has taught Pipe Machinery the best treatment for all their gage materials — and High Speed Steel is no exception. It is Nitrided for extra surface hardness in Pipe Machinery's own heat treating department where nothing is left to chance...where the most rigid standards guarantee uniformly high quality. As is the case with all Pipe Machinery gage materials, it is also submitted to a stabilizing treatment which further assures accuracy and long wear life for the finished gage.

Write today for additional information.

THE
PIPE MACHINERY
COMPANY

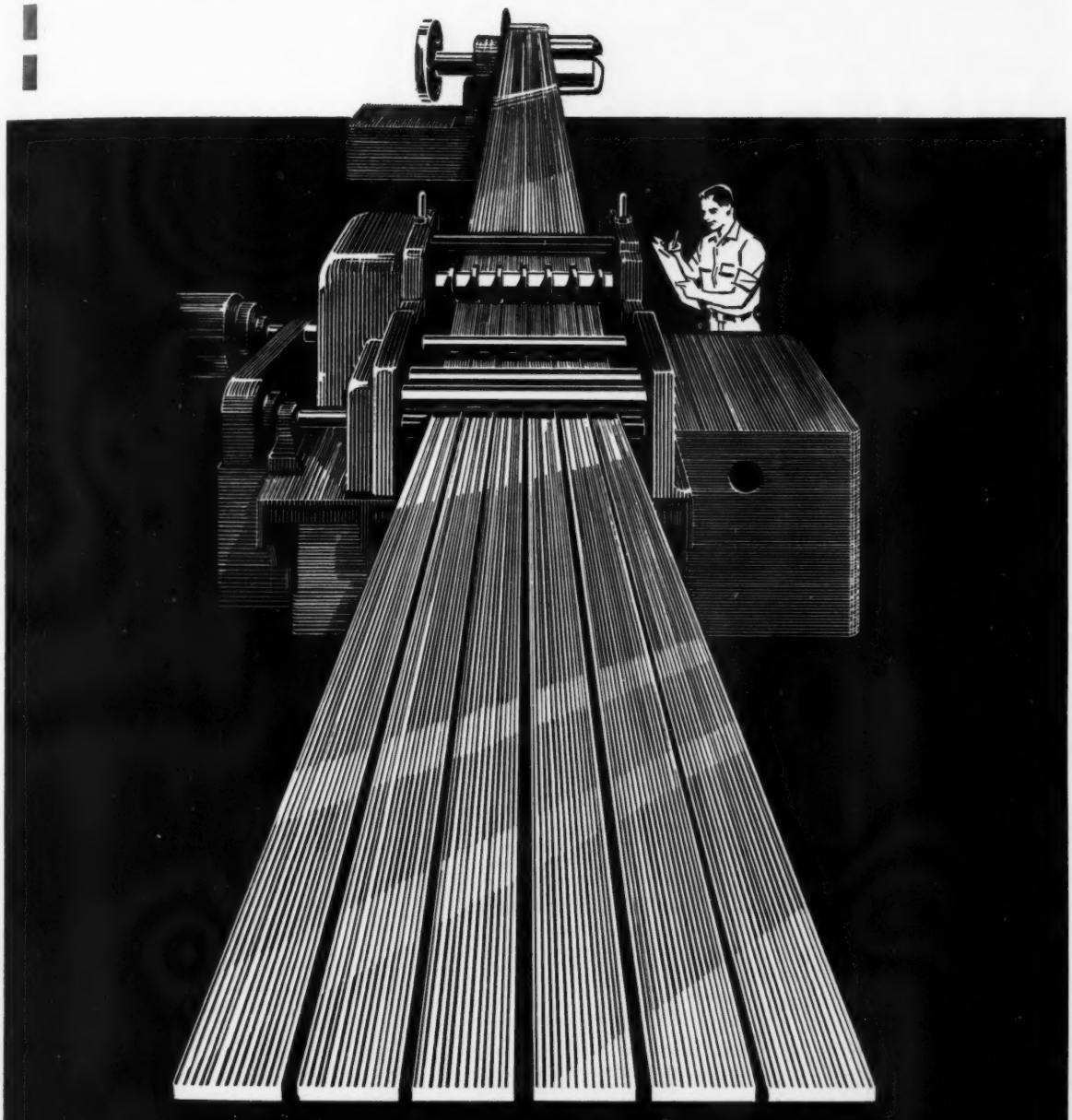
89100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 28

YODER

Rotary Slitters—Product dependability—integrity of manufacture—engineering for specific production needs have all contributed to establish Yoder equipment as the industry standard of excellence. Since 1909 Yoder-built machinery, including Pipe and Tube Mills, Roll Forming Equipment and Rotary Slitters, have earned world-wide customer satisfaction and recognition. Profit from Yoder's years of engineering and service experience. Send today for the illustrated Yoder Slitter Book.

THE YODER COMPANY • 5501 Walworth Avenue • Cleveland 2, Ohio



ENGINEERING YODER MANUFACTURING

ROTARY SLITTING LINES

PIPE AND TUBE MILLS (ferrous or non-ferrous)
COLD ROLL FORMING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 29

Now

AUTOMATIC POSITIONING

with the

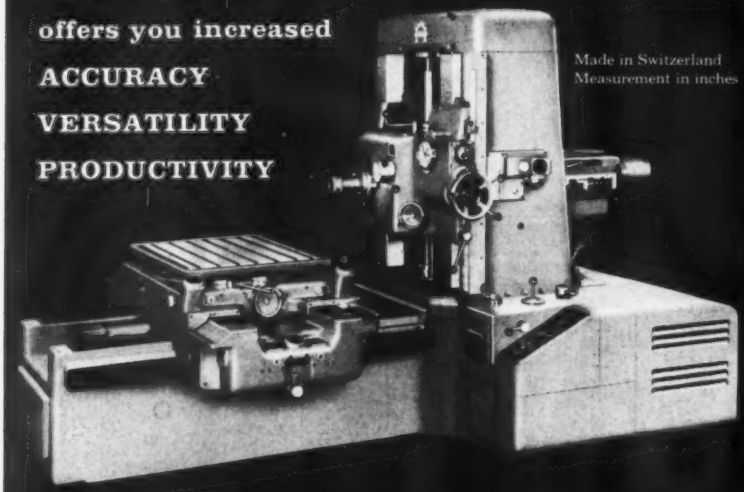
DIXI 75 horizontal optical jig borer

offers you increased

ACCURACY

VERSATILITY

PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting — direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

See the DIXI 75 in operation at the
WESTERN METAL CONGRESS AND EXPOSITION
Pan-Pacific Auditorium
Los Angeles, Calif.
March 16th-20th

Write for your admission cards to:

Montague-Harris & Co.
893 Folsom Street
San Francisco 7, California

A. J. Phillips Company
328 Magna Vista Avenue
Arcadia, California

MBI

M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery."

CIRCLE INFORM-A-GRAM KEY NO. 30

. . . **Men from page 26**

Personnel changes were announced recently by Parker-Hannifin Corp. **Paul F. Smith,** general manager of Parker Seal, becomes president of that division, and **Scott A. Rogers,** assistant general manager, becomes vice president.

Taking over as chief metallurgist of Denver Division of Gardner-Denver Co., is **Floyd R. Anderson.** He supervises metallurgical operations of all divisions of Gardner-Denver.

Frank U. Hayes has resigned as vice president and assistant general manager of The Bullard Co., to become president and general manager of Sperry Products, Inc.

Ernest H. Schanzlin recently joined Tuthill Co. as chief engineer and directs all of Tuthill's research and engineering activities.

Alfred Sherman, manufacturing vice president of Monarch Machine Tool Co., assumes the office of consulting vice president until his retirement in June. **Frank Graziano** is the newly elected manufacturing vice president and **Louis Kritzer** is general superintendent.

Promotions at the Brainard Steel Strapping Division of Sharon Steel Corp. include **Walter A. Garrett,** assistant general manager of the division; **J. Walter Angell,** assistant to the general manager and in charge of product sales; **John D. Boyer Jr.,** manager of field engineering; and **Fred S. Seybert,** chief engineer, in charge of industrial and plant engineering and tool and product development.

NECROLOGY

George E. Gernon, 58, secretary and honorary director of the Gisholt Machine Co., died in Madison (Wisconsin), Oct. 16.

Victor F. Stine, 65, president of the Pangborn Corp. for the last two years, died Oct. 29.

Verne E. Minich, founder of Wheelabrator Corp. and honorary chairman of the board, died Dec. 13 in New York City hospital, following several months illness.

Ruben O. Peterson, 59, pioneer in the field of power brush engineering and vice president, Brush Division-Engineering, of the Osborn Mfg. Co., died Dec. 28 in Cleveland.

Charles S. Redding, 75, chairman of the board of directors and former president of Leeds & Northrup Co., died in Philadelphia Jan. 2, after a brief illness.

DIE SET DATA

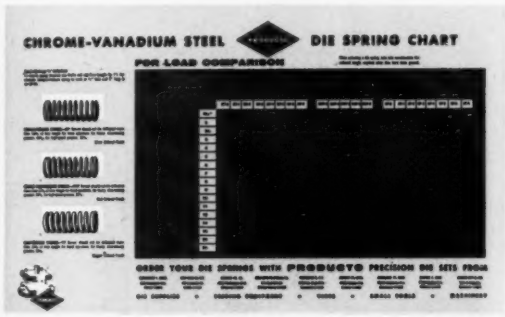
available from PRODUCTO

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

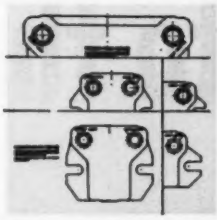
Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*



Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*

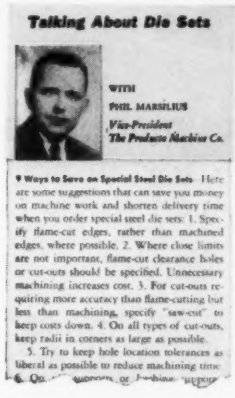


Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.

Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

Announcing for the missile era:

3 new toolroom aces

Accuracy to the split-tenths

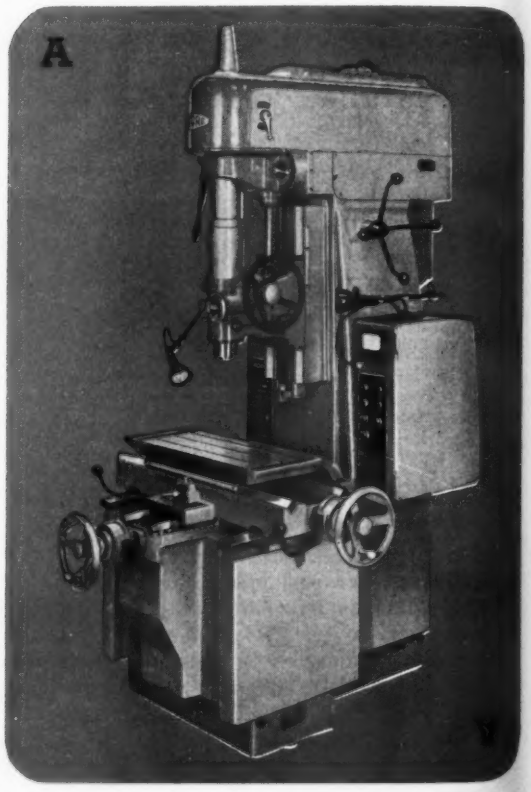
FLASH!

All Moore machines shipped after February 15, 1959 are made and calibrated to the New International Inch

LOCATES AND BORES HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Borer

For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equaled. Now, with this new and larger No. 3 model, you will break the "tenth" barrier! Here's why: it offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive... wider speed range, 60 to 2250 RPM...larger table working surface, 11" x 24"...micro setting of vernier dial... more accessible cross-clamping. These new features, plus sensitive, centralized controls for spindle speeds and feeds, quick tool-changing, easy lubrication add up to a Jig Borer which belongs in every toolroom where *tomorrow's* accuracies must be achieved *today!*



DETAILED LITERATURE ON EACH OF THESE MACHINES IS AVAILABLE ON REQUEST.

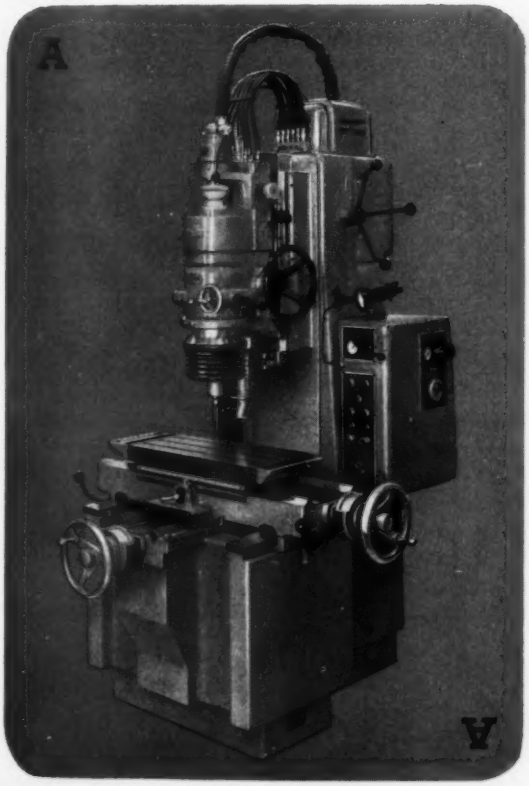
MOORE TOOLS BRIDGEPORT, CONN.

Manufactured by

LOCATES AND GRINDS HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Grinder

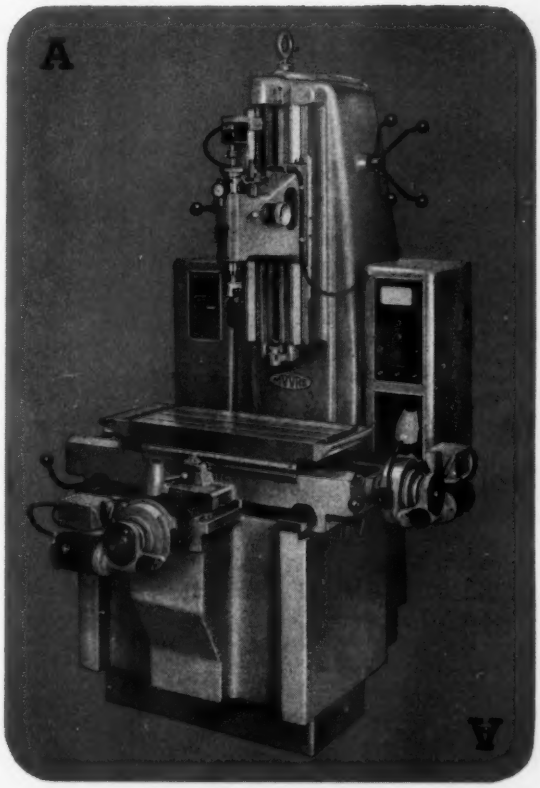
The originators of jig grinding and the Jig Grinder have done it again! Now, with this new, larger No. 3 model, you can grind—*with split-tenth accuracy*—holes plus regular and irregular contours to size and location after hardening. This is made possible by the closer locational tolerances built into the machine... by the all-hardened-ground-and-lapped ways... by the faster strokes provided for chop-grinding... by the infinite spindle speeds, 40 to 250 RPM... by the larger table working surface, 11" x 24". The same quickly set precision lead screws as in the Moore Jig Borer simplify the finish-grinding process.



MEASURES TO ONE-THIRD OF A "TENTH"

Moore Universal Measuring Machine

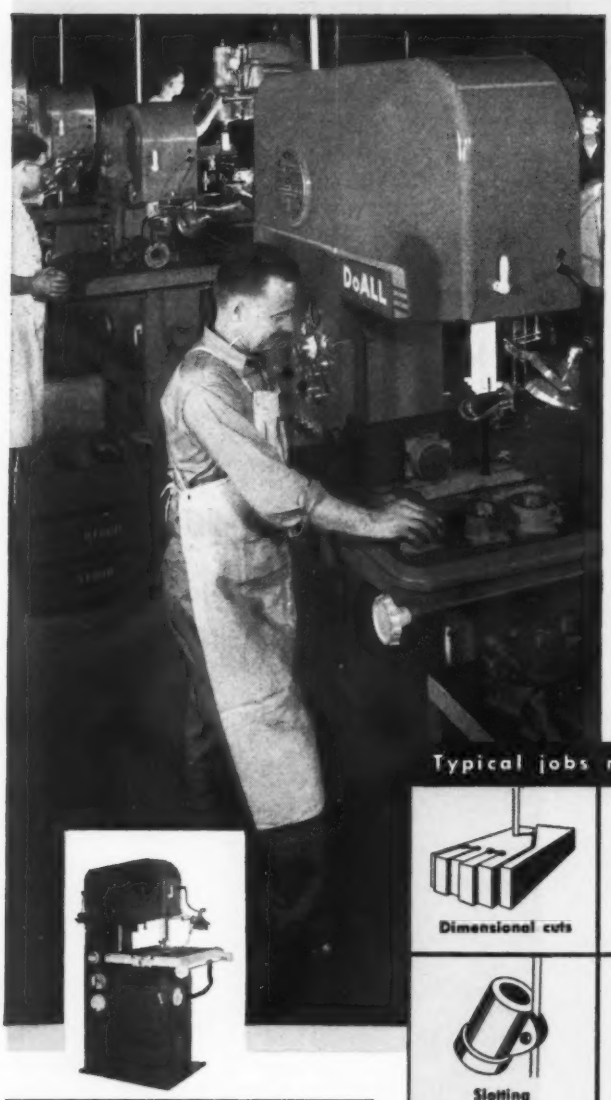
This machine, built on the same basic principles as the No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder, introduces a new concept in ultra-precise measurement and inspection. It offers *for the first time:* A machine combining the capacity for larger work-pieces; choice of electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. Design and construction insure the highest possible accuracy. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive, offered as optional equipment (available only for Measuring Machine).



MOORE SPECIAL TOOL COMPANY, INC., Bridgeport, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 33

DoALL *UPSETS* old machining methods with the NEW Contour-matic® Band Machines



New ways to cut costs

This is the time—*right now*—for production men and methods engineers to take a good, long look at some of the "accepted" machining practices . . . to break away from old habits in the light of new developments and performance in band machining.

Think of it! The new Contour-matics give you an average of 650% faster cutting rate . . . 30 times longer tool life . . . elimination of hand feeding . . . little or no fixturing . . . new standards for accuracy and finish.

In just 30 minutes we'll demonstrate in your plant how the Contour-matic® can reduce your machining costs—on your own work. Savings of 50%, 75%, even 90% are not unusual when you put your slotting, splitting, notching, trimming and facing operations on the table of a Contour-matic. Contours, angles and grinding reliefs are more production-line or toolroom operations now being done with the Contour-matic machine at a fraction of the time and cost of conventional methods.

Our in-plant demonstrations and "job spotting" are services your DoALL machine tool specialist provides without obligation. Let him help you make a realistic appraisal of your basic tools and machining methods. It will pay you to do it now. Call your local DoALL store today.

Typical jobs now spotted for Contour-matic machining

Productive Maintenance is your assurance of continuous, profitable performance on all DoALL machines. It is an included service to all DoALL users. Ask your DoALL representative about "Package Service."

Find Your DoALL Store in The 'Yellow Pages' B-55

This is a typical DoALL store.

The DoALL Company, Des Plaines, Ill.

Call Your DoALL Service-Store

CIRCLE INFORM-A-GRAM KEY NO. 34

The appointment of **James A. Allen** as factory representative of Sales Service Mfg. Co., has been announced by the company. His headquarters will be at the home office in St. Paul, Minn.

Promotion of **W. H. Schomburg** to assistant general sales manager of Dana Corp., has been made known. He replaces **L. D. Dodge,** recently named vice president of administration.

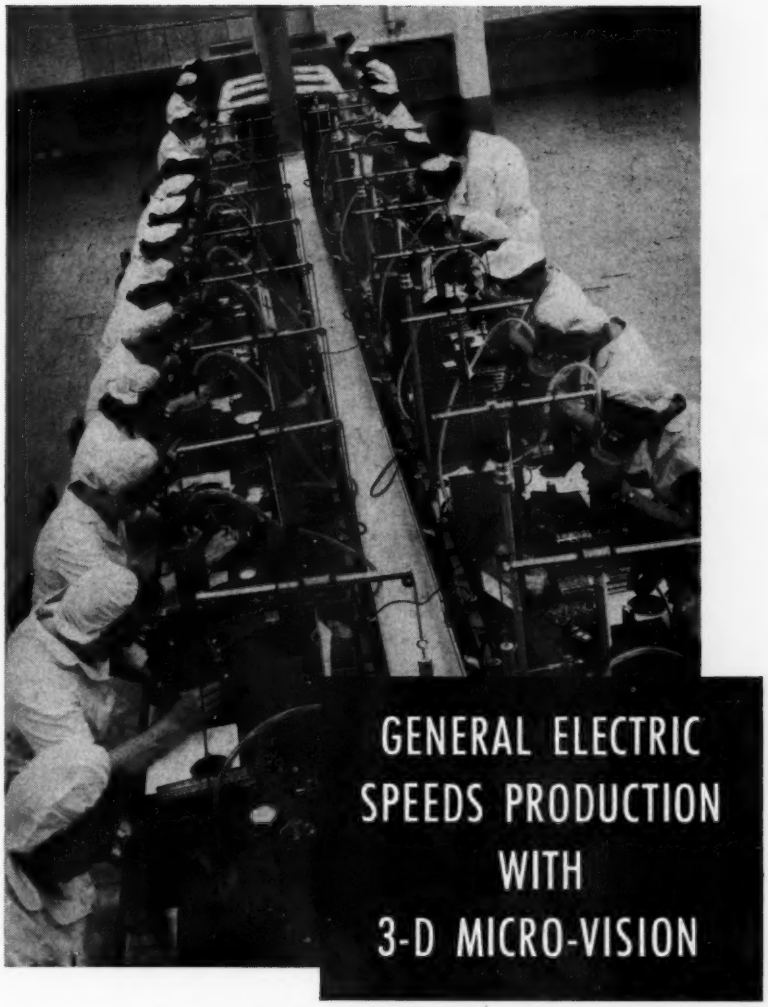
Personnel changes at Detroit Stamping Co. include **William H. Roberts,** executive vice president; **Harry C. Robeson,** vice president of sales; **Herbert McMillan,** sales manager of the Stamping Division; and **Charles Hoppe,** sales manager of the Finished Products Division.

George S. Chiaramonte has moved into the position of sales manager of Cogsdill Twist Drill and Threadwell Tap & Die Divisions of The Sheffield Corp.

James F. Kelly has joined Madison-Relco Tool Co., of Providence, as an area sales manager. His territory includes central and western Massachusetts, Vermont, and New Hampshire.

Wilfred R. Ogg, Chicago district manager of Norton Company's Grinding Machine Division, is now serving as manager of distributor sales for the division. In this newly created position, he supervises machinery distributor activities coming into the Worcester, Mass., office and is in charge of the division's export sales. **Calvin K. Kirk** succeeds Ogg as Chicago district manager, and **Thomas D. Bushman** succeeds Kirk as product research engineer.

Three promotions have been announced by Pratt & Whitney Co., Inc. **George A. Crittenden,** former manager of the Philadelphia office, is now district sales manager of the New York offices and heads cutting tool and gage sales in the New York City area. **Victor H. G. Wadlund** takes over as district manager of Philadelphia, and **Donald A. Heaton** serves as district sales manager in sales activities in the Philadelphia territory.



GENERAL ELECTRIC SPEEDS PRODUCTION WITH 3-D MICRO-VISION

How B&L Stereomicroscopes help in assembly of ultra-precision transistors

These skilled operators are doing a job that "just couldn't be done without stereomicroscopes," according to Norman Spoonley, foreman, Semiconductor Products Dept., General Electric Co., Buffalo. This critical phase of transistor assembly involves soldering a 1-mil nickel wire between a nickel tab and the .6-mil core of a .1" germanium pellet which, in turn, is fused between two 5-mil nickel wires. B&L Stereomicroscopes make it possible by showing enlarged views in natural 3D. Air-tight, dust-free design keeps images sharp, clear, undistorted . . . for full-working-day efficiency without visual fatigue. In assembly, quality control, inspection, some 100 B&L microscopes help G. E. mass-produce to highest precision standards. If you have small-parts assembly and inspection problems, you need B&L Stereomicroscopes.

SEE FOR YOURSELF! MAIL COUPON FOR FREE 15-DAY TRIAL

BAUSCH & LOMB

BAUSCH & LOMB OPTICAL CO.
77339 St. Paul Street, Rochester 2, N.Y.

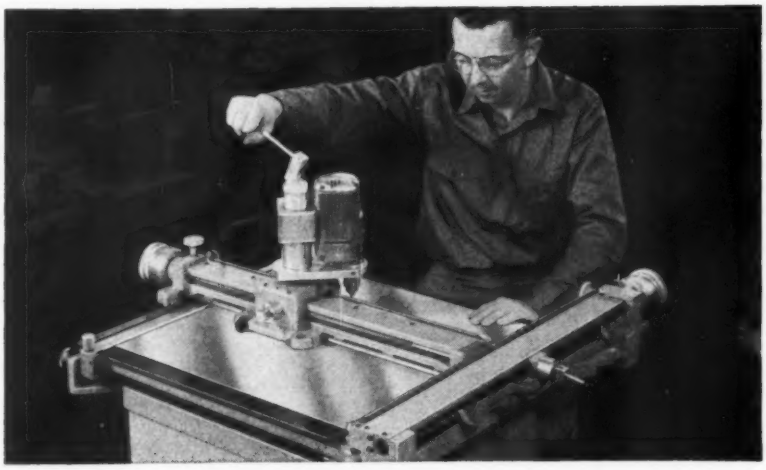
☐ I'd like to borrow a B&L Stereomicroscope for 15-day trial without cost or obligation.

☐ Send me Stereomicroscope Catalog D-15.

Name .....
Title .....
Company .....
Address .....
.....

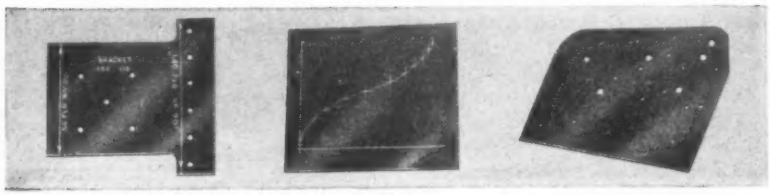
CIRCLE INFORM-A-GRAM KEY NO. 35

layout and
template making time
cut in half . . .



THE NEW **STRIPPIT FLEX-O-DRILL**

- **DRILLS, REAMS, SCRIBES, CENTER PUNCHES** to ± 0.002" WITHOUT base line drawing or height gauge layout!
- **EASY, ACCURATE POSITIONING**—quickly set to any reference point and to nearest 0.100" by adjustable steel tapes reading in both directions from zero. Micrometric gauges then bring settings to nearest 0.001". No optical scanning device needed.
- **LASTING ACCURACY!** Table is an actual ground surface plate. Bridge assembly is of heavy, accurately machined castings. Lead screws are precision ground and engaged only during micrometric gauge settings to minimize wear. All parts are corrosion-resistant. Bearings are protected against dust and chips by felt shields. Drill motor is heavy-duty industrial type.
- **¼" CAPACITY** in mild steel — stock up to 24" width, any length.
- **ALSO A PROVEN MONEY-SAVER** on pilot runs, low unit production.



Template drilled by Flex-O-Drill *Layout scribed by Flex-O-Drill* *Flex-O-Drill work piece*

WRITE FOR LITERATURE TODAY, and an actual demonstration at your plant:

WALES STRIPPIT INC.
212 Buell Road, Akron, New York
In Canada: Strippit Tool & Machine Company, Brampton, Ontario

A UNIT OF HOUDAILLE INDUSTRIES, INC.

CIRCLE INFORM-A-GRAM KEY NO. 36

ESTABLISHING A NEW-PRODUCT PROGRAM. Published by American Management Association, Inc., 1515 Broadway, New York, 36, N. Y., 1958. 124 pages, paperbound, $3 (AMA members: $2).

Today's competitive market makes new-product planning essential. In many cases a successful new-product program has become a measure of company progress. In this report, based on an AMA marketing conference, marketing executives show how to plan, organize, and carry through such a program effectively. They discuss basic factors in product planning, including legal considerations in product development, the role of the industrial designer in the program, and pricing policies for new products. Ways of organizing the program most efficiently through the efforts of the new-product development manager, the product planning committee, or a new-business development division, are also considered. The report also discusses how marketing research determines the size, nature, and location of the potential market, and how it helps to analyze competitive factors in new-product development.

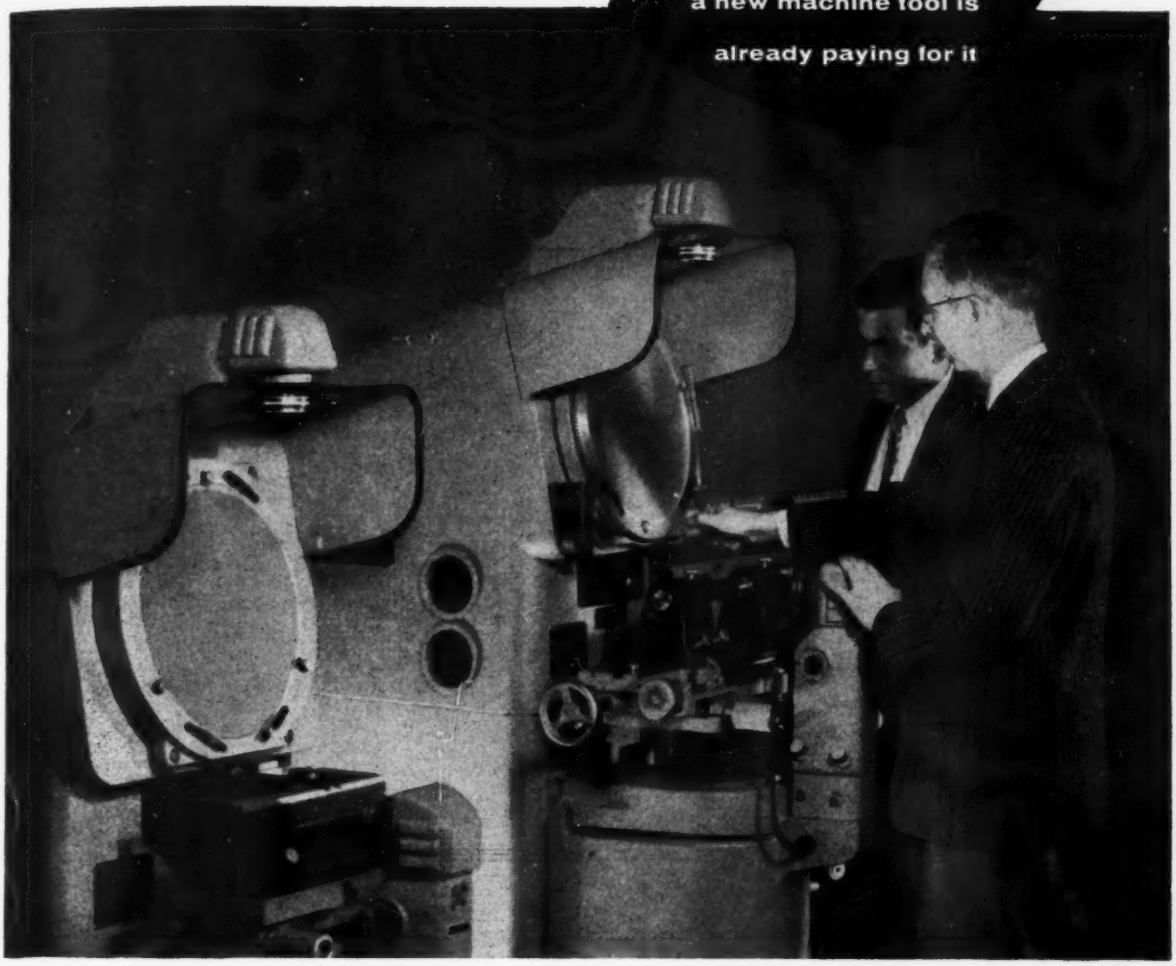
TECHNICAL DRAWING — Fourth Edition, by Giesecke, Mitchell, and Spencer. Published by The Macmillan Co., 60 Fifth Ave., N. Y., 1958. 844 pages, $10.

This new edition of a reference important to designers and engineers covers all of the tools of graphical presentation, incorporating the latest standards and practices. Technical sketching — a very effective means of communication within a plant — is emphasized. The section dealing with nomographs and other methods of graphical calculation is of particular interest since these methods are becoming more widely used in the operations research type of approach to production and inventory planning. Other sections cover shop processes, dimensioning, working drawings, gearing and cams, welding representation, and aeronautical drafting. The book serves well as an introduction for the beginner and as an authoritative reference for all users.

. . . Continued on page 38

JONES & LAMSON OPTICAL COMPARATORS

the man who needs a new machine tool is already paying for it



This is what you should demand in an Optical Comparator

Optical inspection and measuring equipment offers fast operation, extreme accuracy and tremendous versatility. When buying a comparator, be sure you *get* these benefits:

1. Specifically designed *projection* lens system (not just an adaptation of *other* types of lenses).

2. Ball and roll type supported measuring tables (they offer top speed and accuracy).

3. Table assemblies so designed that simple changes can be made in your own plant. (You can change a basic *comparison* machine over to one for universal *measuring* applications, at low cost.)

4. Measuring facilities that offer direct readings without computation. (You save a lot of time, minimize human error, assure accuracy.)

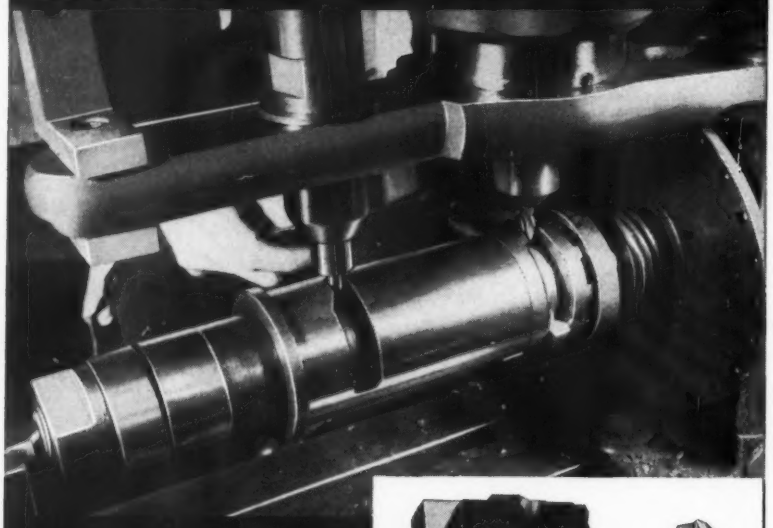
5. Solid mechanical design throughout. (You can't inspect anything very accurately if it's moving.)

Jones & Lamson Optical Comparators and Measuring Machines give you all these features, plus many more. They are explained in detail in our new catalog. Write for a copy today. Jones & Lamson Machine Company, 519 Clinton Street, Springfield, Vermont.

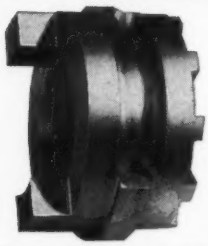
Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

CIRCLE INFORM-A-GRAM KEY NO. 37

'Standard' off-the-shelf End Mill



Speeds Production, Speeds Delivery of Machine Tool Clutch!



Machine tool clutch showing cam track milled with "Standard" Brown & Sharpe End Mill.

½" "Standard" Brown & Sharpe High Speed double-end End Mill.

One of the 72, yes *seventy-two*, different Brown & Sharpe ½" End Mills that cut production days and add dollars of production profits to this job.

Operation: On tracer-controlled milling machine—plunge cut and peripheral mill a cam track contour in special, extra tough alloy steel machine tool clutch.

Choose the correct Brown & Sharpe End Mill from the World's Largest Stock of "Standards" and start production.

Eliminate days of waiting for special tools—eliminate trial and error of unproved tools—with Brown & Sharpe PRODUCTIONEERED CUTTERS!

Send for Catalog showing more than *3400* "Standard" Brown & Sharpe Milling Cutters to: *Cutting Tool Division, Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island.*

FOR THAT EXTRA EDGE IN PRODUCTION

Brown & Sharpe

CUTTING TOOL DIVISION

HIGH SPEED STEEL CUTTERS
NELCO CARBIDE TOOLS
END MILLS

PROGRESS IN PRECISION FOR OVER 125 YEARS

CIRCLE INFORM-A-GRAM KEY NO. 38

COATED ABRASIVES — MODERN TOOL OF INDUSTRY. Coated Abrasives Manufacturers' Institute. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York, N. Y., 1958. 426 pages, $8.50.

This book brings together a great deal of authoritative information to aid in the selection and use of coated abrasives. The nature of various types and applications of abrasives are comprehensively covered. Effective uses of abrasives in metalworking and other industries, in applications ranging from heavy material removal to fine polishing, are described in the book. Coverage includes new automatic machinery and applications, such as strip-scouring and pre-plate finishing. A section on coolants, cutting oils, and lubricants for use with coated abrasives is also included.

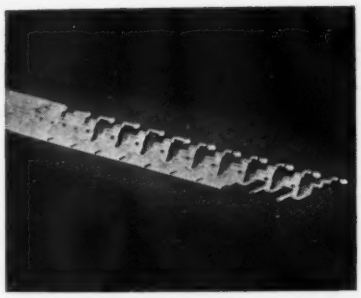
STATIC CONTROL — Application Manual. Published by General Purpose Control Dept., General Electric Co., Bloomington, Ill., 1958. 152 pages, paperbound, $5.

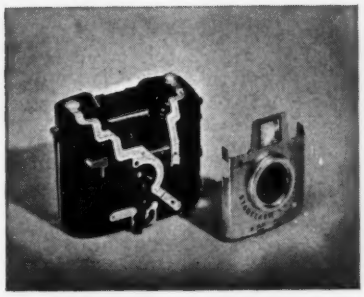
The fundamentals of static control, including why, when, and where it should be used in industrial applications, are presented in this new book. It states that the best application for static control is where a large number of information signals are used to operate a few power devices. Designers as well as users of electrical control systems will be interested in the sections on the operation of components, circuit design, panel layout, drilling plans and wiring diagrams, and system checkout. All components are fully illustrated and circuit diagrams for many applications are presented. A glossary of technical terms is included.

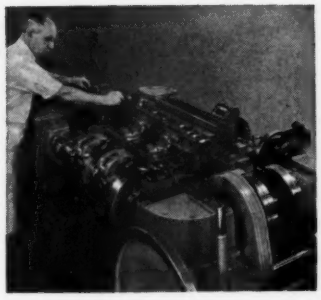
SHEET MATERIALS FOR HIGH TEMPERATURE SERVICE. Published by American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio, 1958. 74 pages, paperbound, $2.95.

This compilation of papers presented at the Southwestern Metal Congress in May, 1958, gives up-to-date information on the properties and uses of the jet-age metals. A comprehensive paper on cold roll-forming of stainless steels, and a discussion of techniques used in joining, and then inspecting, alloys of titanium, stainless steel, aluminum, and magnesium-thorium, are included in the report. Other papers presented at the Metal Congress are included in two companion reports: "High Strength Steels for Aircraft" and "New Fabrication Techniques."

U.S. MULTI-SLIDE® CONTRIBUTES TO SUCCESS OF KODAK BROWNIE STARFLASH!







Manufacture of a reliable, practical camera, with a built-in flash, that will sell at a popular price calls for considerable engineering skill and technical know-how. It calls for good design and sturdy construction. It demands consistently accurate production — unwavering accuracy at high speeds. ● Eastman Kodak Company has been using U.S. Multi-Slide Machines for many years and has found them satisfactory in high volume production of irregularly shaped parts. Parts are manufactured without intermediate handling or secondary operations that would have been required by conventional methods. Presently, Eastman Kodak Company's Apparatus & Optical Division uses U.S. Multi-Slides for the production of no less than six parts for Brownie Star Cameras; the Starflash, Starflex and Starlet. ● A Model #33 U.S. Multi-Slide is used to produce battery connectors for the Brownie Starflash. The machine is arranged with multiple rams and tooling with three separate die stages — producing a completed part at each cycle. ● Because of their versatility, the U.S. Multi-Slides could be readily adapted by Eastman Kodak's A. & O. Division to manufacture other flat stock stampings, wire parts, or the simultaneous feeding and processing of more than one strip to complete an assembly. Prefabricated parts could be hoppered, positioned and assembled to the stamping being made in the machine. ● **Write today to find out how U.S. Multi-Slides can produce your stamped components better and more efficiently . . . ask for Bulletin #15P or send in samples or drawings of the part you want produced.**

ILLUSTRATED ABOVE: The popular Kodak Brownie Starflash Camera . . . **LEFT TO RIGHT:** Successive stages in the production of Brownie Starflash Battery Connectors as stamped by U. S. Model #33 Multi-Slide . . . Brownie Starflash Camera disassembled (built-in flash removed) to show location of battery connector produced on a #33 U. S. Multi-Slide, part of flash synchronization circuitry . . . U. S. Multi-Slide Model #33 in use at Eastman Kodak Company's Apparatus & Optical Division in Rochester, New York . . . Machine is turning out battery connectors for the Brownie Starflash Camera.

U. S. TOOL COMPANY, INC. AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

US MULTI-SLIDE

CIRCLE INFORM-A-GRAM KEY NO. 39

DECKEL *LK Machine Tool Series Brings You...*

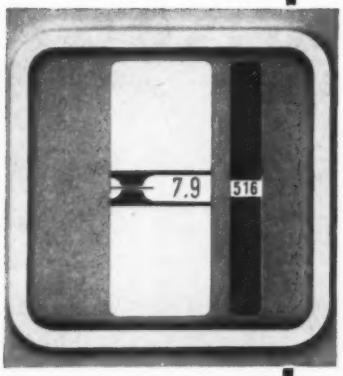
Direct Numerical Readings To .0001"

And Interchangeable Heads

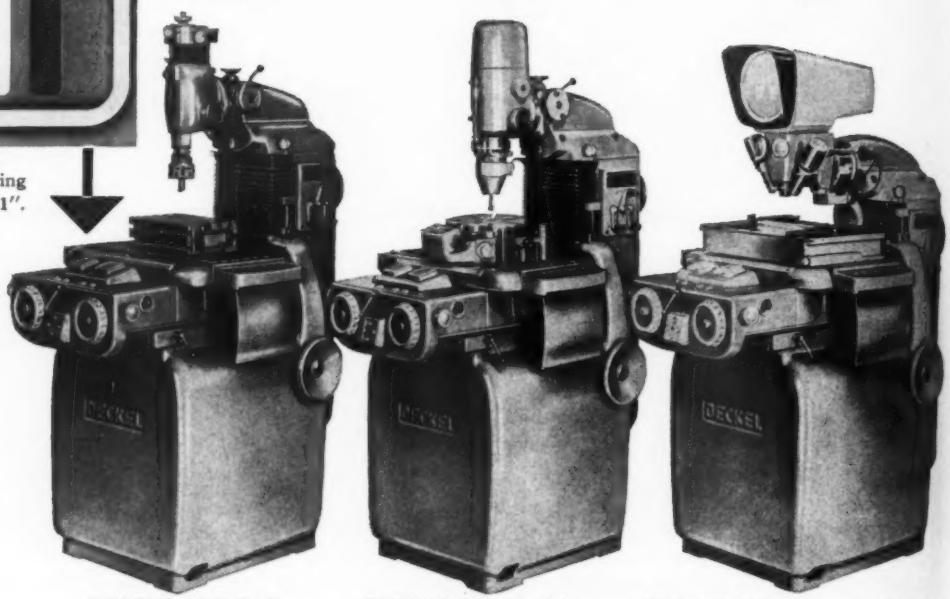
for

Optical Coordinate

Jig Boring **Jig Grinding** **Profile Measuring**



Projection screen showing scale readings to .0001".



DECKEL LKB Jig Borer
Worktable area: 25.6" x 11.8"

DECKEL LKS Jig Grinder
Worktable area: 25.6" x 11.8"

DECKEL LKM Measuring Machine
Magnification: 10X, 20X

This outstanding machine tool development couldn't be more timely. The new DECKEL LK series of optical coordinate machine tools combines economy with extreme precision—at a time when these two factors are highly critical.

Three Machines In One—Simple interchangeability of jig boring, jig grinding and profile measuring heads gives you a choice of one, two or three machines on one universal base. Change from one head to another takes only minutes. Used individually, each one of these machines will give you remarkable accuracy and performance.

Direct Numerical Readings—For the first time on any machine tool, coordinate table settings *can be read directly in numbers* to ten-thousandths (.0001") of an inch. No conversions or interpolations are needed. Reading errors are practically impossible. Actual positioning accuracy is within .00012".

Thermal Expansion Compensation—The inherent accuracy of these machines is protected by a unique thermal expansion compensating device—built-in to the supporting bracket. Dissipation of heat from the gear box and drive motor provides additional thermal stability.

Write For Additional Information

COSA *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

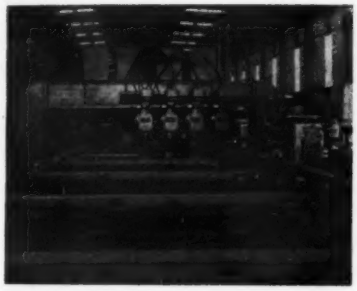
CIRCLE INFORM-A-GRAM KEY NO. 40

AUTOMATIC RIVETER'S PRODUCTION EQUAL TO 40 HAND RIVETERS

Automation entered the field of trailer and truck body manufacture with the installation by Dorsey Trailers of what is probably the world's largest and fastest automatic riveter. An electronically-controlled Drivmatic riveter, of the type previously used exclusively by aircraft manufacturers, installs 6,000 rivets for a trailer's sides, front, and roof in less than one hour.

Costing nearly a half-million dollars, the equipment required over two years of development work by the company's engineers and General Riveters, Inc.

The fact that Drivmatic-riveted joints are tight enough to hold fuel in jet airplane wings without sealant is evidence of the increased strength the machine builds into a stressed-skin trailer. Uniformity of spacing and rivet heads, as well as secure joints, result because the Drivmatic, being completely automatic, virtually eliminates human error.

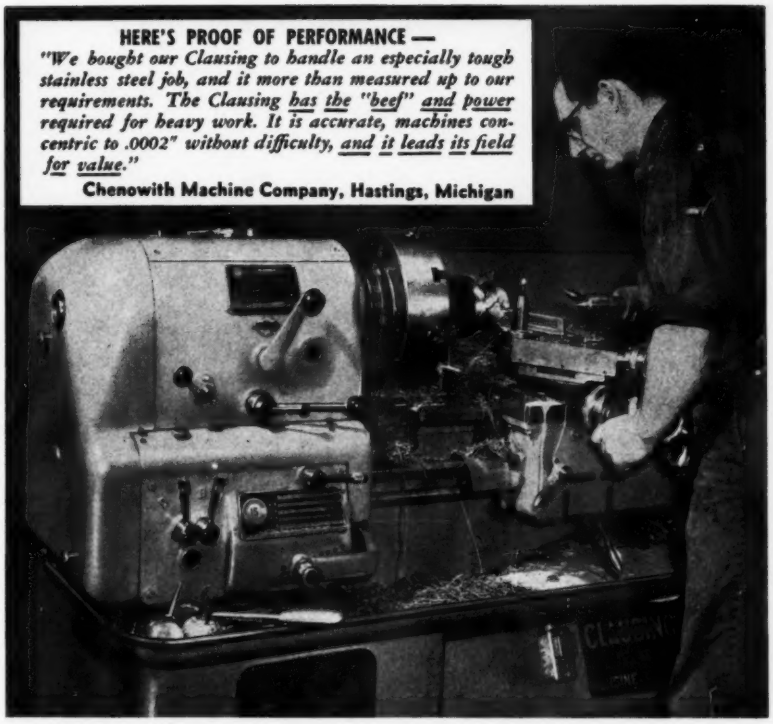


The Dorsey installation involved the adaptation of Drivmatic riveters to a bridge-type structure large enough to handle an entire van side as a complete unit. The machine has four riveting heads and is the first multiple unit Drivmatic produced. combines into one continuous cycle the following individual operations: (1) Clamping side sheet and stiffener post together at the point to be riveted; (2) Drilling rivet hole; (3) Inserting rivet; (4) Upsetting the bottom of the slug with a hydraulically-powered squeezing action while rivet head is held by bucking anvil. The pressure also tightens the rivet in the hole.

With all four heads operating, the machine runs continuously for the length of a side post, then rivets the next run in the other direction. Electronic controls activated by a template guide the operation.

. . . **Continued on page 42**

HERE'S PROOF OF PERFORMANCE —
"We bought our Clausing to handle an especially tough stainless steel job, and it more than measured up to our requirements. The Clausing has the "beef" and power required for heavy work. It is accurate, machines concentric to .0002" without difficulty, and it leads its field for value."
Chenowith Machine Company, Hastings, Michigan



Performance records PROVE

CLAUSING COLCHESTER LATHES'

Superior Construction . . . Greater Value

Clausing geared-head lathes do lead their field in capacity, performance and value, Here's why:

They're bigger in capacity than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. 17" lathe spindle, for example, has $3\frac{1}{16}$" thru hole – 15" lathe, $2\frac{1}{16}$" hole – 13", $1\frac{9}{16}$" hole.

Have heavy-duty construction. Massively built throughout. Bed ways are induction hardened. Gears in head and quick-change box run in bath of oil. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile steel.

Built for precision performance – to American standards of toolroom lathe accuracy. Have Gamet Micron tapered roller bearings with oil flow lubrication – the most advanced and accurate bearings known to industry.

Each is an outstanding value. 13" cabinet base models, including motor and controls, start at $2113; 15" cabinet base at $2988; 17" at $4715. You owe it to yourself to investigate before investing in *any* lathe.

Lathe Capacities: 17" lathe: 54" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

CLAUSING DIVISION *Write for Free Literature*
ATLAS PRESS COMPANY
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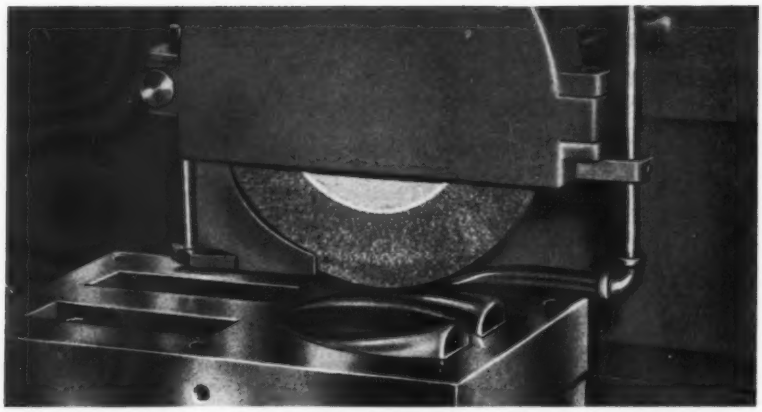
CIRCLE INFORM-A-GRAM KEY NO. 41

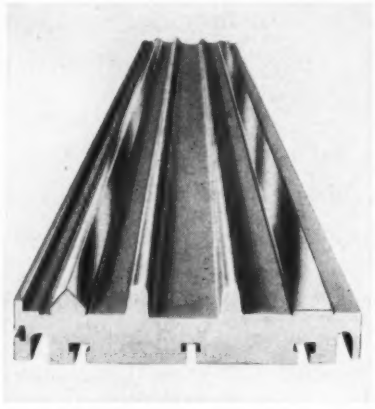


Micro-precision extended for years
ON EVERY COVEL TOOL-ROOM SURFACE GRINDER

Grinding plastic mold dies like this calls for MICRO-PRECISION . . . and the 14" x 24" Covel "60" has it! Also accurately grinds trim, forming. blanking and die-casting dies in addition to jigs, fixtures, dovetail and flat form tools. Ideal for high speed or carbide production parts grinding, too. Covel precision grinders save you money because they give new-machine performance longer—stay "front-and-center" in your tool-room grinder lineup for years and years of MICRO-PRECISION performance. That's because Covel-pioneered features preserve new-machine accuracy longer—for example, hard chrome table ways maintain built-in accuracy far beyond the life of ordinary ways. Before you buy your next surface grinder, it will pay you to learn all the facts about this and other Covel advances.

First with hard chrome table ways

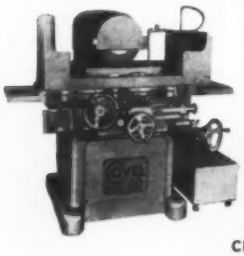
A special plating process developed by Covel applies a hard chrome surface to hand-scraped Vee and flat table ways insuring long-lived accuracy. Many Covel chrome plated ways have been in service for ten years and more without noticeable wear and without a sign of flaking.



Why Covel outperforms other tool-room surface grinders

Hydraulic rapid traverse with 15" cross feed, power elevation and high speed make the Covel "60" able to outperform machines costing much more. Elevating hand wheel is *below* table level and all controls are grouped for easy operation. Optional hydraulic wheel truing device automatically provides a truer grinding surface. *Write for catalog today.*

Micro-Precision a Covel Tradition-Since 1874



Send today for your copy of "The Covel Precision Story" and complete data on the Covel Surface Grinder that meets your needs — seven sizes from 6" x 12" to 16" x 36". Ask for Bulletin T-39.

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 42

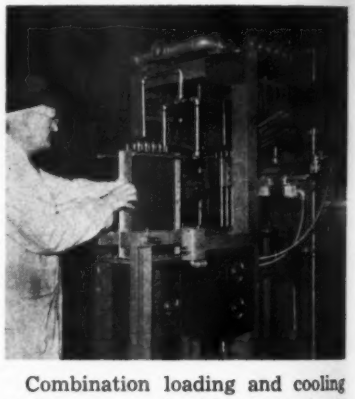
. . . Riveter from page 41

The sheets and stiffeners for a complete trailer side are first assembled in a frame, which then moves through the riveting machine on a table. The machine starts riveting at one corner, goes down one row of rivets, jumps to the next row and comes back, then to the next row, etc. Meanwhile, the frame holds the structure rigidly in position.

The riveter is practically "silent" when compared with the din that 40 hand riveters would make doing the same amount of work! This in itself, Dorsey engineers say, dramatizes the fact that being squeezed instead of pounded, automatically-installed rivets create tighter and stronger joints, more quietly.

HEATING COILS BRAZED ON AUTOMATIC UNIT

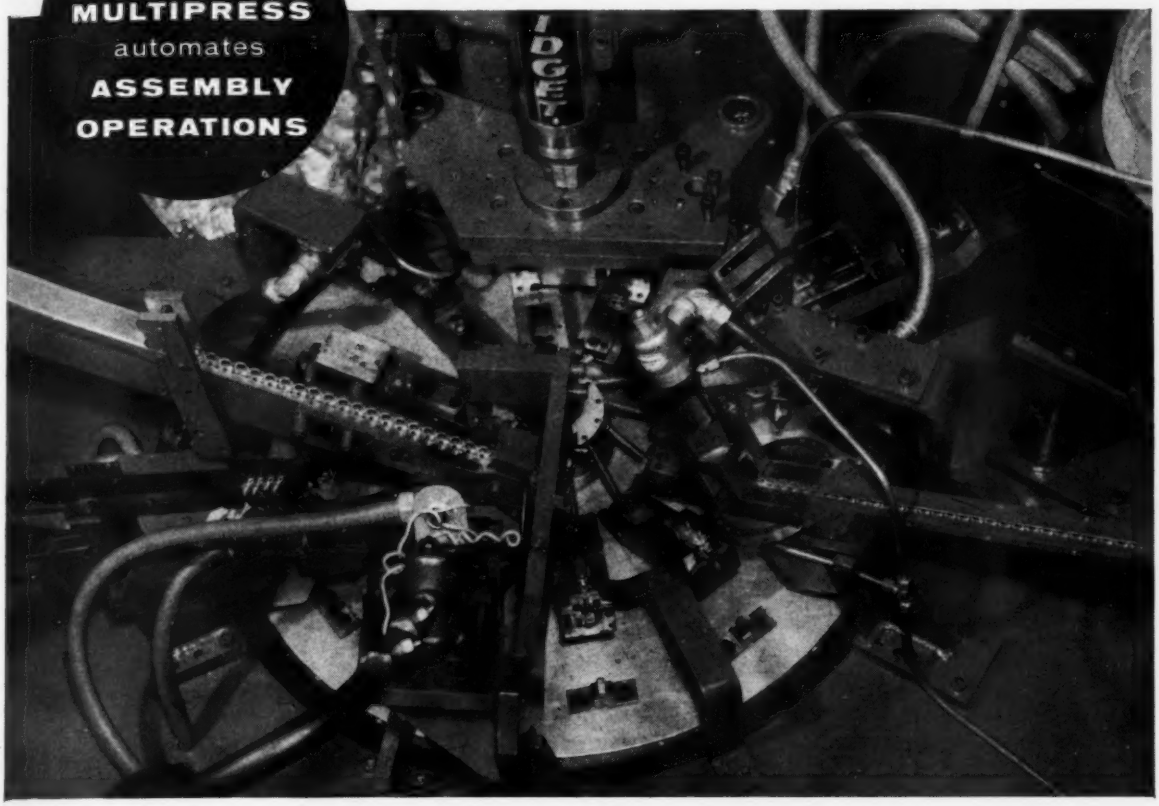
A shuttle type gas-fired brazing unit brazes U-shaped return bends on heating and cooling coils, without distorting the aluminum fins of the coils. The unit, built by Gas Appliance Service, Inc., requires a single operator and automatically produces uniformly brazed coils at the rate of 40-50 units/hr.



Combination loading and cooling stations, on each side of the heating station, are served by a two position air-operated carriage equipped with adjustable support fixtures. Multiple gas burner heads, adjustable for various sizes of coil, are automatically operated as coil is moved into the heating station. Heating is automatically timed, and when brazing is completed the coil is moved back into the loading station, where an automatically-timed blast of air speeds the cooling operation. Meanwhile, another coil from the loading-cooling station on the opposite side of the unit has moved into the heating station.

How **DENISON MULTIPRESS** automates **ASSEMBLY OPERATIONS**

45 assemblies-per-minute *are produced on this 1-ton Denison hydraulic Multipress and automatic index table at the Unique Balance Division, S. H. Pomeroy Company, Dubuque, Iowa.*



MULTIPRESS assembles and inspects complex 4-part components

...at a rate of 2700-per-hour

With this Denison hydraulic Multipress and feeding devices, production assembly of complex units has been increased and costs reduced considerably.

Completely automatic, the particular operation shown assembles and inspects the four-part assemblies at a rate of 45-per-minute... *2700-per-hour.* Any defective assemblies are automatically rejected. The operator has only to supervise the equipment and load component hoppers.

The automatic operation shown is typical of how multi-component assembly operations can be simplified with Denison hydraulic Multipress and simple tooling. The Denison field man near you can help analyze your work and demonstrate how you can duplicate these savings in your plant. Write for the Denison catalog describing the full line of Multipress units for your work.

4-part assembly *of spring tension unit for sash balances, used on double-hung windows to replace conventional sash cord and weights.*

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

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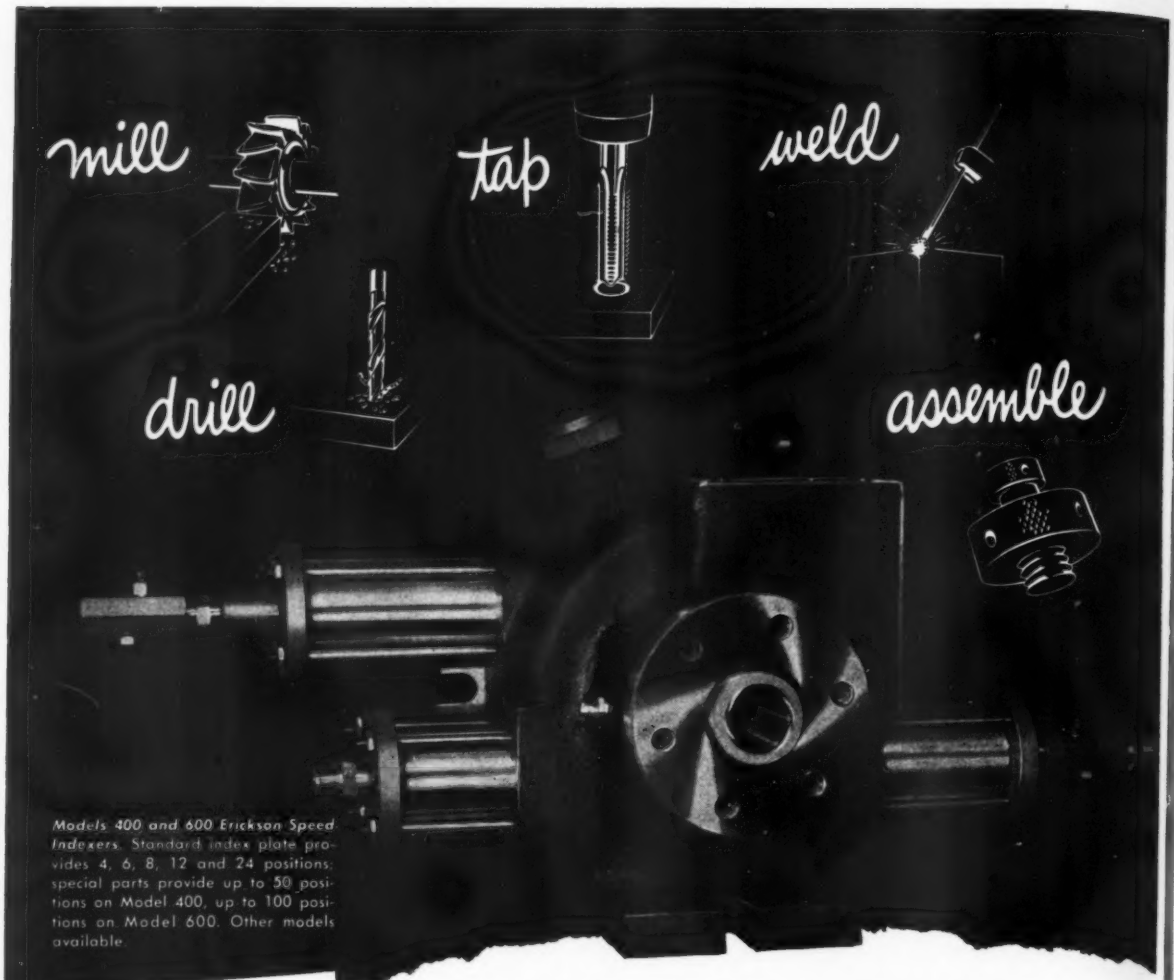
DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

CIRCLE INFORM-A-GRAM KEY NO. 43



Models 400 and 600 Erickson Speed Indexers. Standard index plate provides 4, 6, 8, 12 and 24 positions; special parts provide up to 50 positions on Model 400, up to 100 positions on Model 600. Other models available.

Angular accuracy within 2 minutes... repetitive accuracy in low "tenths" of a thousandth

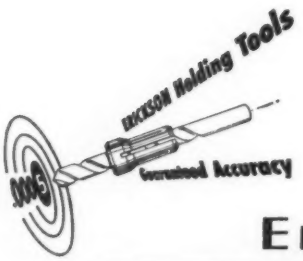
ERICKSON INDEXERS–

the economical way to smash automation bottlenecks

Even the most elaborate automatic production line can bog down *expensively* without rapid and accurate automatic parts positioning.

That's where Erickson Indexers really pay off. For you can interlock them into your production set-up with micro switches and solenoid valves. The hardened and ground lock pin operates in conjunction with the actuating mechanism to assure *positive positioning and angular accuracy within 2 minutes of a degree.* (Repetitive accuracy is no indication of angular accuracy. Erickson holds repetitive accuracy in low "tenths" of a thousandth.) And Erickson Indexers can maintain this great accuracy because their adjustable, self-contained shock control unit delivers a cushioned rotary load to the mechanism, thereby reducing wear.

Speed to keep lines moving . . . accuracy to reduce rejects . . . long life to cut maintenance and capital investment – all add up to Erickson Indexers, the *economical* way to smash automation bottlenecks.



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CIRCLE INFORM-A-GRAM KEY NO. 44

SCIENTIFIC EDUCATION -- BASICS vs GADGETRY

I DO NOT WISH TO APPEAR as an alarmist. obstructionist, or an old fashioned hangover from the readin', writin', and 'rithmetic school, but I probably will be called all of those, and more, depending on who's reading.

Actually, I am a most enthusiastic advocate of more and better scientific education, particularly at the pre-college level, BUT . . . .

I am firmly convinced that there are hidden dangers in some of the good things that are on the educational agenda today—the various sugar coatings on the educational pill.

First of all, can't we agree that there are no substitutes for inspired and dedicated teachers? The one accepted value on which we must build tomorrow's educational give and take is that teachers are people, and students are people. Their behavior patterns are those of people—not robots.

The latest innovations in school plant and equipment, swimming pools in every corridor, roof-top solariums, infra-red ovens in the cafeteria, do not enhance by one iota the all-important rapport that must exist between student and teacher—the two-way static-free channel of communications whereby they can read each other "loud and clear."

Now, how about teachers vs "gadgets" as teaching aids?

When Congress passed the Science Education Bill $300,000,000 in Federal funds became available to the nation's 27,000 high schools (to be matched by an equal amount from the States) for upgrading and accelerating science study; a $600,000,000 jackpot for *equipment* with which to assist our already underpaid teachers!

We are not going to get our future scientists and engineers from the conglomeration of masonry, plumbing, wiring, soft lighting and acoustic ceilings of the high school physics lab; we are going to get them from the teachers' enthusiasm and ability in selling science to the students.

The teachers' ability to awaken interest and to sustain interest has to come from within—it has to spring from an enthusiasm that can not be "built-in" by lush budgets or expensive and intricate apparatus—particularly demonstration apparatus that, in itself, is way above the level of the student's study progress when used.

Here are a couple examples of what I mean. Remember when you were studying electricity? You dunked a bar magnet into a coil of wire. The magnet's lines of force sliced through the coil's windings and "induced" a momentary electric current. You were told, and read, that this was so, but how did you prove it?

You simply connected a second coil to the first one and as the induced current flowed through the second coil, the resultant magnetic lines of force made a 98¢ pocket compass go like crazy! As long as you were willing to believe your eyes, it was a pretty convincing demonstration (and has stuck with me for quite a few years.)

But is it good enough today? No! Today's physics course layer-outers, connect the first mentioned coil to a vacuum tube voltmeter and a cathode ray oscilloscope and prove the same thing, to the tune of at least $200 vs 98¢!

Here's another: should it be necessary to employ a microphone, vacuum tube voltmeter, oscilloscope, amplifier and loudspeaker to demonstrate that the harder a simple tuning fork is struck the more intense its sound, and that if its arms are "loaded" or slowed down, the lower the pitch of its note?

I'm only contending that the punishment should fit the crime, or that simple basic physics phenomena should be demonstrated by equally simple manifestations. Such is the true challenge to a teacher.

If a teacher can approximate the circumstances and equipment of a pioneer researcher—can it not be a most effective dramatization of how things came to be, or must we engage in electronic theatricals before the student is ready?

Also I'd like to see a modicum of personalization injected into the study of sciences—bring the study to life in terms of people. In the study of electricity an ampere is an ampere is an ampere, and that's that. But how about a word on Andre Marie Ampere, 1775-1836, who was the first to make a clear distinction between particles, molecules, and atoms? Is that too heady for a high school science student?

Must we perpetrate a crash program with such glamorous apparatus that make the simplicity of the basic concepts boring by comparison? The teacher must, and can, glamorize the subject.

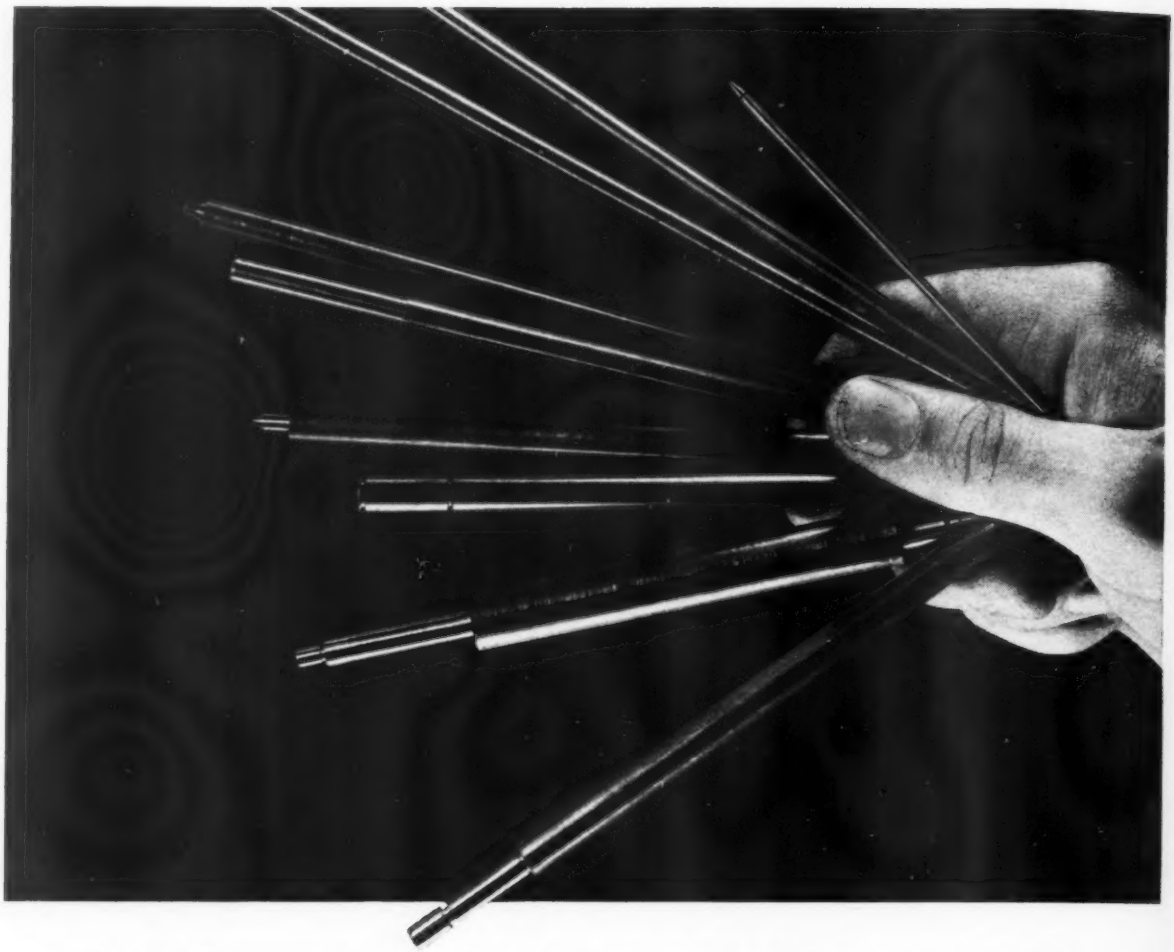
In other words, why doesn't your local auto club and high school use Indianapolis racing cars for driver training?

Admittedly, I've both over-simplified and exaggerated in order to make my point, simply because I think the point needs making.

If any agree with me, I probably won't hear from them. But I'll bet I get you-know-what from those who don't!

E. Willard Pennington

Editor



Which will inspect these shafts faster... mechanical or optical gaging?

Over 25 different metal shafts go into the calculators made by Monroe Calculating Machine Company.

In the past, inspection of these shafts required the use of a large number of "go" and "no-go" gages. Rate? *About 7 per minute.* In addition, gage surveillance was both time-consuming and expensive.

Then the switch was made to optical gaging, using a Kodak Contour Projector. The method is simple: A master shaft is positioned to either upper or lower tolerance limits on the screen. Then the part to be inspected is placed in the same position.

Rate with optical gaging? *About 17 per minute!* And, there's no longer a need to send gages back to the crib for resetting. One Kodak Contour Projector does the whole job.

Besides saving time, optical gaging with a Kodak Contour Projector offers you a chance to *cut* down on gage costs, use operators with little or no training, and often obtain accuracy *not* possible by other means.

Where can you use optical gaging? Almost *anywhere* in the plant—receiving, assembly, production, final inspection, toolroom.

Facts about Kodak Contour Projectors are spelled out in a brochure which you can get by writing to the address below. After you've had a chance to look over the contents of the book, we'd like to demonstrate *why* and *how* one of the six Kodak models will best fit your inspection needs.

Use of low-cost Model 8 Kodak Contour Projectors enabled the Monroe Calculating Machine Co., a division of Litton Industries, to more than double inspection rates.

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AUTOMATIC PARTS FEEDING

TOOLING & PRODUCTION Magazine

by Allston L. House
Product Engineer
WESTERN ELECTRIC COMPANY, INC.
Allentown Works

The automatic parts feeding systems developed for the dry reed switch assembly machines handle difficult sorting operations with unique mechanical and photoelectric devices to provide the necessary consistent supply of parts.

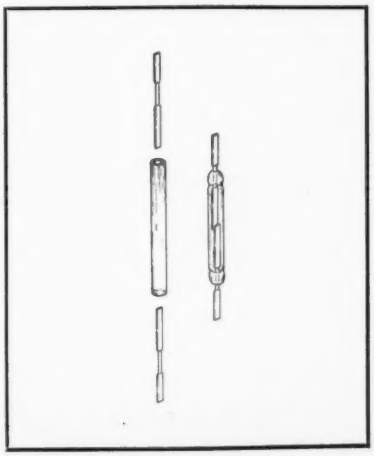
AUTOMATIC PARTS FEEDING SYSTEMS are often as difficult to develop as the automatic machines they serve. Once the design problems are solved the resultant systems may be so complex that their costs become prohibitive. Hence, the anomalous but not infrequent situation in which an operator is used to feed parts to an automatic machine.

When the engineers at the Allentown Works were faced with the development of a machine for manufacturing dry reed switches, they realized that the low costs required of the switch would not permit manual loading of parts. They solved the problems of orienting unsymmetrical reeds and rejecting reeds that were bent with a system employing mechanical and photo-electrical devices. Although appearing rather complex, the feed systems operate with the high degree of reliability that is essential for proper machine operation.

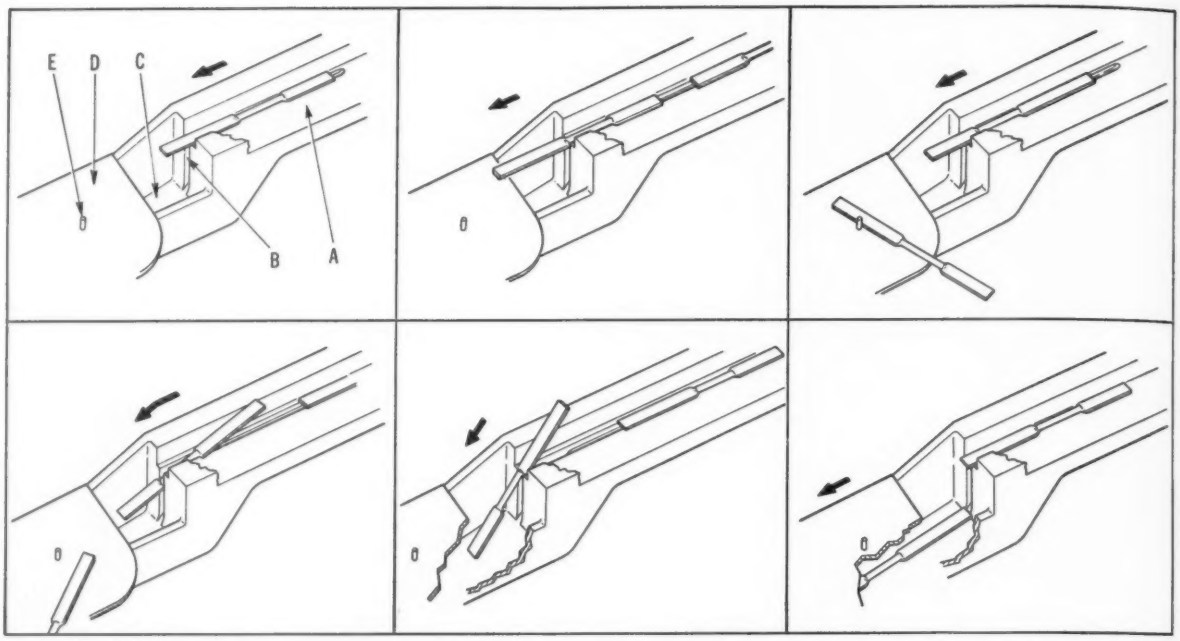
There are three parts to a dry reed switch, a glass tube and two identical metal parts called reeds, as shown in the illustration on this page. On the assembly machine there is a separate feed system for each, capable of supplying a part every ten seconds. The input to each feed system is a vibratory bowl which can hold several hours' supply of parts. The action of the bowls is to move the parts into a feed track that leads to the machine. Between the track and machine is a transfer mechanism working in time with the machine which takes part from the track and inserts them into the machine.

Since the glass tube is a symmetrically shaped part, the system for its feeding presented no unusual problems. However, the metal reeds are unsymmetrical. Thus, each reed must be properly oriented before it can enter the machine. Further, some

Exploded view (left) shows the three parts of a dry reed switch: glass tube (center) and two identical reeds (top and bottom).



Editor's Note: This article by Mr. House originally appeared in the October 1958 issue of "The Western Electric Engineer." We are grateful to Western Electric for permission to relay his ingenious assembly mechanization know-how to our readers. E. W. P.



Correct orientation of the unsymmetrical reeds is achieved mechanically near the end of the spiral track inside the vibratory bowl pictured below. If the desired orientation is short end first and the long end is forward (top left), the longer flat section is supported on surface "A" until it reaches surface "D." It continues forward on "D" (top center) and is reversed by pin "E" (top right). It then drops back into the bowl (bottom left). A correctly oriented reed moves along surface "A" but before it bridges the gap to surface "D," the round center section falls into slot "B" and causes the short end to drop into the entrance to the feed track "C" (bottom center and right). The same sorting device is used to feed reeds in both directions. When it is used to feed the long end first, the entrance to the feed track is located at "D" and the reversing pin "E" is transferred to the lower level at "C." One bowl does not have sufficient capacity to feed reeds in both directions simultaneously.

of the reeds are bent and can cause jams in some parts of the feed system.

Both reed feeding systems are almost identical, because the parts are identical. They differ only in the direction of orientation of the parts. The system for feeding the bottom reed will be described.

How Bottom Reed Is Fed

The overall feed system consists of a vibratory bowl, mechanical orientation sorting device, bent reed detector, photoelectric reed orientation checking device, vibratory bowl control, and transfer arm mechanism.

The vibratory bowl is a commercial device which accepts parts in bulk and drives them by vibratory action up an inclined spiral track to the start of a feed system. Because of the orientation requirement, the lining up of reeds in a track did not meet all the requirements. They also had to be correctly oriented. Since by the laws of chance it could be expected that one half of the reeds would be incorrectly oriented, it was desirable to divert the rejects back into the bowl. Therefore, the mechanical sorting device is located in the bowl near the end of the spiral track.

Since the weight per unit length of the reed is fairly uniform, the shape had to be used as the basis of the mechanical sorting device. The schematic drawing explains the operation of the device. Rejected reeds are turned into the direction of correct orientation as they leave so that the per cent of incorrectly oriented reeds does not increase as the bowl empties.

The engineers recognized from the outset that the mechanical sorting device could not be completely effective, since it could not operate properly on reeds that overlap one another or on those that are on edge. Experience has indicated that about 5% of the reeds leaving the sorter are misoriented. The photoelectric checking device, to be described later, was developed to remove these few misoriented reeds as they moved down the track.

Bent Reeds Detected

In order to prevent bent reeds from entering and jamming the feed track, a bent reed detector is stationed at the entrance. The bent reed detector is composed of a section of hinged feed track with smaller dimensions than the balance of the track so that it acts as a gage and a funnelling device for guiding the reeds into the track. A phototransistor system is used for detecting reeds that are wedged in the track. It controls an air cylinder that opens the hinged track and ejects stuck reeds. Originally, the device was manually operated but about 5% of the assembly machine production time was lost because the operator was unable to clear jams immediately.

Located next in the track is the photoelectric reed orientation checking device. Inspecting a reed for orientation while it is falling down the feed track presents a rather difficult problem. It would have been

As reeds leave the vibratory bowl (off picture at upper right), they pass downward along the slanting feed track and pass various protective devices: A—bent reed detector, B—photoelectric reed orientation device, C—vibratory bowl control, D—transfer arm mechanism, and E—removable section of track for jammed reeds.

easier to stop the reed, examine it for orientation with a phototransistor system and use a mechanical gate to accept or reject it. However, the latter approach was not used for several reasons: stopping the reed would slow the rate of feed; a gate in this type of track would be complicated and slow in operating; the addition of more parts would complicate the system.

Detector Design

The detection device operates on the principle that the round section of the reed will pass more light than the flat section. Mounted in the track are three phototransistors under their respective lights. Their location is arranged so that a correctly oriented reed will momentarily (for 0.001 sec) cover all three phototransistors with its flat sections as it passes down the track, but so that this condition cannot occur if the reed is incorrectly oriented. The very slight difference in the phototransistors' output between the two conditions is amplified so that it can be detected to control the device which accepts or rejects the parts.

The device for accepting or rejecting parts permits acceptable reeds to continue down the track, but the rejects fall down through a hole in the bottom of the track which is located below the detecting device. This is essentially a trap door arrangement, but in place of a hinged mechanical section a short blast of air which is controlled by the detection device is applied to support the properly oriented reeds across the hole. A purely mechanical device would be too slow to work in the short time required for a reed to go from the detection device to the hole.

How Vibratory Bowl Works

The vibratory bowl control is used to combine two different rates, that of the continuous feeding bowl to the cyclical or intermittent machine feed. The bottom section of the track acts as a storage magazine from which the transfer arm can obtain parts. The removal of parts is on an indexing basis at constant rate (360/hr). A phototransistor is mounted in the track so that its light is blocked by the sixth reed in storage. However, when the quantity drops to five or less, light hits the phototransistor which then actuates the control circuits to activate the bowl vibrations. This action continues until there are six units in storage again. The feed rate of the bowl must be high enough to feed reeds to storage faster than the machine removes them, while also supplying those that can be expected to be rejected by the mechanical sorter and other traps in the feed system.

A transfer arm mechanism is used to take the reed from its sloping position in the storage section and revolve it upright for supplying the assembly heads. On the pickup side of the transfer arm are two springs used for holding the reed while it is being transferred. The top of the arm is used to keep the reed in the reservoir from falling out until the arm is in position again. In case there is a jam at this point, one short section of track is made removable. When a jam occurs, the piece can be removed and the troublesome reed easily ejected.

It is of interest to note that the first set of feed systems used photoelectric cells for sensing devices. However, because of the advantages of miniaturization in the feed systems, phototransistors were used instead soon after they became available through their manufacture at Allentown.

In the early stages of production of dry reed switches, jams occurring in the feed tracks caused more downtime than all the other components of the machine combined. However, after several months of trouble shooting, with minor changes and adjustments being made, the downtime was reduced to a minimum — the replacement of worn parts resulting from normal wear. It is estimated by maintenance personnel that the present assembly machine downtime resulting from the feed tracks is less than one hr/machine/month. A system which causes no more lost time than this can be considered essentially trouble free.

end

The reasoning behind the designing and building of this combination of Kearney & Trecker chip-making and General Electric automatic tape-controlled programming was that more than 75% of all metalworking manufacturers in this country make products in lots of 25 or less.

AUTOMATIC TOOL CHANGER

. . . a Flexible Automated Machining Center

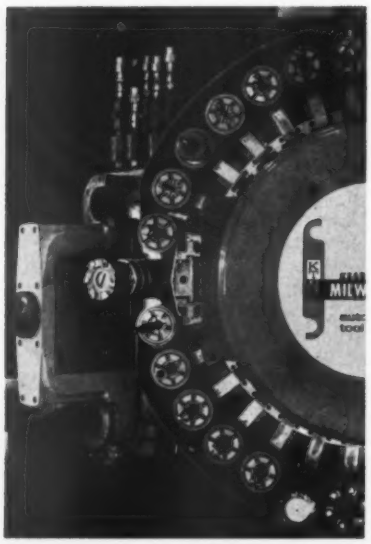
WHEN ONE TAPE-PROGRAMMED MACHINE TOOL incorporates 31 milling, drilling, reaming, tapping, and/or boring tools, automatic and selective loading of those tools in the spindle, and automatic transfer of a workpiece to (first) the chip-making position, and (second) to the unloading position—that one machine becomes, literally, an automated job shop. Thus may Kearney & Trecker's new Milwaukee-Matic be introduced.

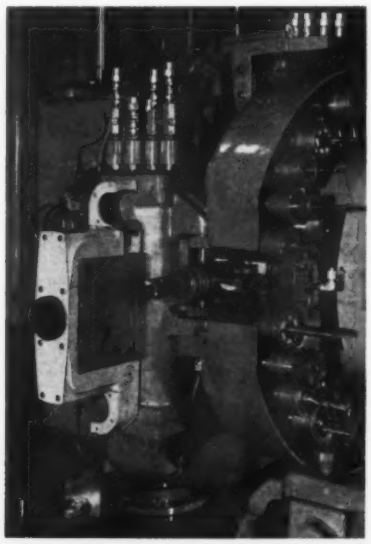
The photo immediately above shows the rotary tool magazine loaded to capacity with 30 different tools—the 31st tool is accounted for in the machine spindle—each chucked in a coded holder. The tool change arm is in its "parked" position, and the tool selection "reader head" can be seen next to the shell end mill.

The photos below show in sequence (left) the tool change arm and selected tool holder in the first stage of the 8-sec changeover; (center) the tool change arm and selected tool holder in the transfer position, and (right) the tool arm fully extended and simultaneously gripping the tool holders in both the magazine and the spindle.

The tool-selecting reader head's mechanical fingers, which make possible a positive selection from a possible 961 tool style and sizes, can be seen directly to the right of the selected tool.

end





PATENT TALK vs THE ENGLISH LANGUAGE

by Theodore L. Chisholm
Patent Section
Central Office Staff
GENERAL MOTORS CORPORATION
Detroit, Michigan

The Patent Attorney's English Must Define the Scope of the Invention.

"WHY CAN'T THE ENGLISH," wails one of the characters in *My Fair Lady*, "learn to speak?"

"Why can't the patent attorneys," complain the engineers, "learn to write plain English? Why do they use weird terms for everyday mechanical things and tangle these terms into a fantastic obscurity of language?"

The engineers have a point. While many patents are clear and easy to read, it is true that many are inexcusably difficult. One of the reasons for this is plain poor writing. There are, however, other patents which are well written but annoy engineers and judges with their unfamiliar and difficult terms. These people want to know, for example, why the term "translating device" is used to refer to a plain electric light bulb, or why a simple clutch is referred to as a means responsive to an increase of fluid pressure adapted to establish drive through a transmission. This requires explanation.

Claims Must Separate Old from New

In writing the claims of a patent the patent attorney is writing for the inventor — the inventor's declaration of what is his under the invention and what is not. This declaration binds the inventor the next 17 years. Thus, the patent attorney must write a definition of the thing invented which will do all of the following:

(a) It must exclude everything done before — that is, distinguish from the prior art.

(b) It must include the essential elements of the inventions—that is, enumerate all parts and relationships without which the invention would not work.

(c) It must *not* include non-essential parts or relationships, for the wording of the claim should represent the inventor's statement of what his invention is. He stands or falls by that statement. If an unnecessary part has been included in this statement, a competitor can often use the invention, leave out this unnecessary part, and avoid the patent entirely.

(d) It should include all conceivable equivalents of each individual element that is included in the invention because, while the law attempts inherently to give each inventor a reasonable range of equivalents, there can be expensive arguments of uncertain outcome as to whether a certain thing is an equivalent.

This last is a large and difficult responsibility. Attempting to carry it out frequently results in language which engineers do not appreciate and judges do not understand, but which is both proper and necessary.

Nomenclature for Protection

Suppose the patent attorney is writing a patent application on an invention for controlling the rate of flow of oil into a clutch for an automatic transmission. Suppose it is necessary to include the clutch as an element of the claim, but the essence of the invention is in the apparatus for controlling the flow, in combination with the clutch. There are reasons why the patent attorney cannot just say "a clutch."

Basically, what the clutch does is selectively make or break the drive train through the transmission. Many forms of device can do this satisfactorily for this purpose. A simple, traditional disk clutch connecting an input to an output shaft will do. So will a fluid drive — that is, a pump and a turbine which make the drive through the transmission when they are filled with oil and break it when empty. But is this properly termed a clutch? This question has been debated extensively. Likewise, the drive can be made by having one side of the disk clutch grounded and the other side connected to a reaction gear of a planetary gear set to stop or hold the reaction gear. Is this clutch still a clutch? Engineers call it a clutch, patent attorneys think it is a clutch, but the Patent Office says it is not. The Patent Office says it is not to be called a clutch but it can be called a brake.

This results from a Patent Office rule based on its definition of a clutch as invariably joining together two rotating parts and its definition of a brake as invariably having one stationary part. No clutch can ever be a brake and vice versa. So the Patent Office requires attorneys to distinguish and elect between clutch and brake.

In this hypothetical case, it makes no difference which is involved. An obvious suggestion is to say "clutch or brake." But, this runs afoul of a second Patent Office rule against using alternative expressions in claims. So the patent attorney must say something which means either or both and yet complies with Patent

From: General Motors Engineering Journal. Permission to reprint is gratefully acknowledged. E.W.P., Editor.

Office rules. If there were some recognized word like "brutch" or "clake," it would be simple. Since there is not, the patent attorney must find a term or expression which means any form of clutch, brake, or equivalent device which selectively establishes drive through a transmission and breaks the drive.

The patent attorney is now driven to an approach inherent in basic English and Pacific pidgin English. The clutch or brake becomes a thing that is used to make or break drive through a transmission when it is pumped full of oil under pressure. This is reminiscent of pidgin English for piano; namely, "big-fella-box — you-fight-him-he-cry." The patent attorney dignified this into "means responsive to an increase of fluid pressure adapted selectively to establish and interrupt torque in the transmission."

So much for the *claims*. In those parts of the *description*, which are illustrative only and do not state the claim nor mark out the breadth of the invention, it is not necessary to the protection sought to use such clumsy terms. But this nomenclature frequently is carried through the entire patent description by momentum or through force of habit in writing. This does make difficult reading. It may even be dangerous — for example, when a judge responsible for deciding an infringement suit does not understand the patent nomenclature or is annoyed with it.

The Goal: to Help a Layman Understand

If, however, the patent attorney uses plain simple terms, like clutch, in the *description* and then, without transition, jumps to pidgin English in the claims, the engineer and the judge justifiably wonder what the claims mean. Many litigants, having contradictory opinions, have hired expensive patent experts to explain to the court their contentions as to the meaning of a claim, or even a single term.

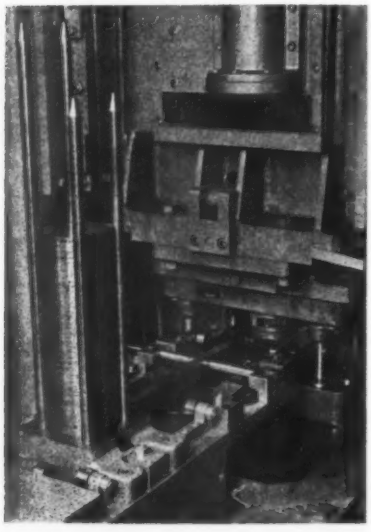
This gets the careful patent attorney into the desirable habit of having his language in the description bear some recognizable resemblance to the wording of his claims. This can be done by making the description its own translation of the claims so that judge, engineer, and lawyer can understand every term in the patent. Suppose the drawing, which illustrates merely one form of the invention and is part of the patent, shows a clutch identified by a reference character 19. The description might be worded: "The clutch 19 connects shafts 20 and 21 when its actuating chamber 22 is filled. This is illustrative of any suitable device which can selectively establish and interrupt drive through the transmission when supplied with oil under pressure and emptied, respectively."

Thus, the selective use of the English language can provide a bridge from the engineer's clutch to the patent attorney's legal language in that part of the patent which is analagous to a deed. end

FAST NEW PRESS TURNS OUT 250-300 PCS/MIN

FRACTIONAL HORSEPOWER MOTOR ROTOR laminations are banged out almost three times as fast as ever before on a new press recently unveiled by Precision Weld-

Fig. 1. Precision Flexofinger feeder uses spring-loaded fingers in reciprocating and stationary guides to slide the blanket silicon steel "cookies" from the stack into the die. It is linked by timing chain with the press crankshaft.



er & Flexopress Corp. The company guarantees a 250 pc/min rate, although production can go over the 300 pc/min mark.

The 100-ton press is a good example of the trend to more efficiency by careful matching of machine elements to specific tool requirements. The system is readily adaptable for other secondary operations and increases the feasibility of such operations. The savings possible by use of simpler dies, rather than progressive dies, for example, and the prospect of longer die life, will also add to the usefulness of this type of press.

Two of the design features that permit such high speed operation are the pre-loaded ball bearing raceways for the ram and the precision feed mechanism that retains positive control of the part throughout the work cycle. Balls riding in v-type ways under preload, a patented feature of all the company's presses, permit them to guarantee accuracy of 0.0005 in 12″ for parallelism between ramface and bed.

The blank feed mechanism (Fig. 1) is driven from the main drive of the press for synchronization with the ram and can be adapted to a wide range of sizes and shapes of workpieces.

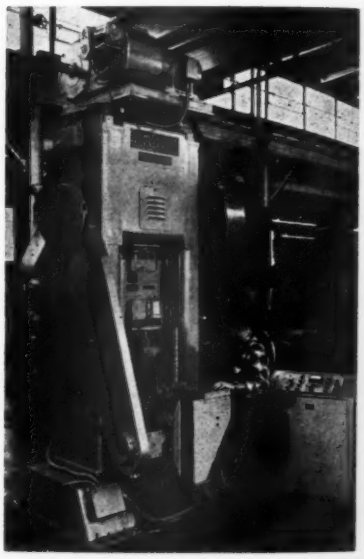
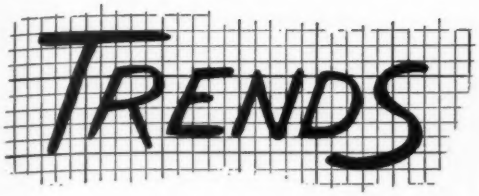


Fig. 2. High speed 100-ton blanking press with Flexofinger feeder that can bang out 300 stator laminations each minute. The stack of blanks is 2 min work for the press.

As an indication of things to come, a target for this type of application within a few years is a 1000 pc/min rate. end

HEAT TREATING TODAY — First of a Series



IN FURNACE AND EQUIPMENT DESIGN

by Lester F. Spencer
West Allis, Wisconsin
and
Charles Weiner
Assistant Editor

When Mama is asked by the young bride how she manages to make such nice pies and cakes, she has a ready answer. According to Mama, it's simply a matter of adding a pinch of this and a dash of that, putting it in an oven, and taking the finished product out "when it's ready." The bride ends up by consulting the cookbook and using the trial and error method. Modern heat treating is like cooking, but every day the heat treat cookbook is getting bigger, and some of the costly guesswork is being eliminated.

AS WE PROGRESS IN TECHNOLOGY AND SCIENCE, metals are being used in more complex applications and under a wider variety of environmental conditions than ever before. A thorough understanding of how to control and change the properties of metals is necessary in order to keep up with these new demands. Metallurgical research and development is constantly striving to uncover more knowledge in this direction. Producers in the metalworking industry are benefiting from this work when they receive better materials, with well-defined properties, and improved techniques and equipment for modifying these properties by heat treating.

Heat treatment procedures are based on the influence of controlled heating and cooling on micro-structure, to obtain desired properties. Machinability, hardness, impact strength, wear and corrosion resistance, tensile strength, and ductility are typical properties affected by heat treatment. Heat treating processes such as annealing, hardening, and tempering are used to achieve the desired results.

Regardless of the heat treatment employed, certain basic factors are important for establishing good practices for quality work. These factors include: a) control of the atmosphere surrounding the workpiece to prevent undesirable surface reactions in the heating or cooling phase of a heat treatment; b) choice of the proper furnace and auxiliary equipment; c) the operating technique; and d) knowledge of the basic characteristics of materials and of the transformations that occur in them.

This article will discuss trends in heat treating and the general classes of furnaces and components used: subsequent articles will deal with other important factors.

TABLE I

	ADVANTAGES	DISADVANTAGES
Electrically-Fired	1. Adaptable to accurate temperature control. 2. Clean. 3. No burner or proportioning equipment problems to maintain combustion.	1. High initial cost. 2. High operating cost. 3. Absence of convected heat except when fans are used. 4. Requires prepared atmosphere unless straight oxidizing temperature is satisfactory. 5. Fixed maximum load capacity for unit floor area.
Gas-Fired	1. Adaptable to accurate temperature control. 2. Clean. 3. Provides convection heat as well as radiant heat in open type furnaces. 4. Provides furnace atmosphere which may be satisfactory for many heating operations. 5. Heat input can be readily increased. This is a question of economics rather than capacity.	1. High operating cost as compared to oil-fired, however lower than electric. 2. Requires blowers for combustion air which are added sources of expense and maintenance. 3. Requires equipment for proportioning air and gas which is subject to adjustment and maintenance problems. 4. Requires accurate sizing of burner equipment to minimize difficulties in obtaining turn-down on burners. 5. Possible explosion hazards. 6. Subject to intermittent supply in some areas.
Oil-Fired	1. Comparatively low operating cost.	1. Not as readily controlled as gas or electric. 2. More difficult to obtain proper combustion. 3. Requires pumping, sometimes heating, both of which add to maintenance cost. 4. Requires combustion air blower. 5. Dirtier; requires periodic clean-out of burners. 6. Products of combustion are harder on refractories and alloy furnace parts such as muffles. 7. Generally operates at a lower combustion efficiency due to the necessity of excess air for combustion.

Fuels and Furnaces

Heating equipment utilizes gas, oil, or electric heat, according to the type of installation and intended application. The choice of heat source involves a number of factors, which may include cost, purity, availability, ease of firing, storage, maintenance, and auxiliary chemical reactions within the product heated. An evaluation of these variables is essential. The advantages and disadvantages of the heating mediums, as given in Table I, should be considered carefully.

Furnaces are classed as either the batch type or the continuous type; this refers to the method of material handling employed. In the batch type the material to be heated is loaded into the furnace and remains stationary until it is withdrawn when the heating cycle is completed. Continuous furnaces use mechanical devices to move the material through the furnace during the cycle.

Furnaces are designed with specific uses in mind and further classification is based on the particular heat treating operation performed.

Of recent design and comparatively wide acceptance, however, are the "all purpose" batch type furnaces, marketed under various trade names. These furnaces which have features frequently found in the larger continuous furnaces, are made in several sizes up to 1600 lb capacity, and are attractive because of their flexibility.

They can be used for clean and bright annealing, gas carburizing, carbo-nitriding, carbon restoration, and isothermal treatments such as austempering and marquenching. By varying the type of atmosphere surrounding the work, the desired results can be achieved without having to use a different furnace for each process.

The main features of "all purpose" furnaces include forced convection within the heating chamber to assure uniformity of temperature, the use of radiant tube heating (when oil or gas is used as the fuel) to obtain rapid and efficient heating, forced circulatory quenching with provisions for heating the quenching medium in the event that an isothermal heat treatment is employed, and the use of auxiliary equipment to permit automatic operation.

Radiant Tube Heat Transfer

Many changes in furnace design involve the methods used to transfer heat to the work. In muffle type gas- and oil-fired furnaces, heat is conducted through metal or refractory muffles and then is transferred to the work by radiation from the muffle walls. Muffle type furnaces are designed for operation with a protective atmosphere in which the muffle prevents contamination of this atmosphere with the products of combustion.

The advent of radiant tube heating, developed to compete with electric furnace design, eliminates the high alloy-muffle with its maintenance and replacement problems. These tubes, which may be of varied design (including both straight and curved sections), are made from a cast heat resistant alloy. They prevent the products of combustion from reacting with the furnace atmosphere or furnace charge during heat treatment. Since these radiant tubes are under slight suction, any leakage that may occur is inward, thus preventing contamination of the furnace atmosphere. This condition is easily detected for replacement of the tube.

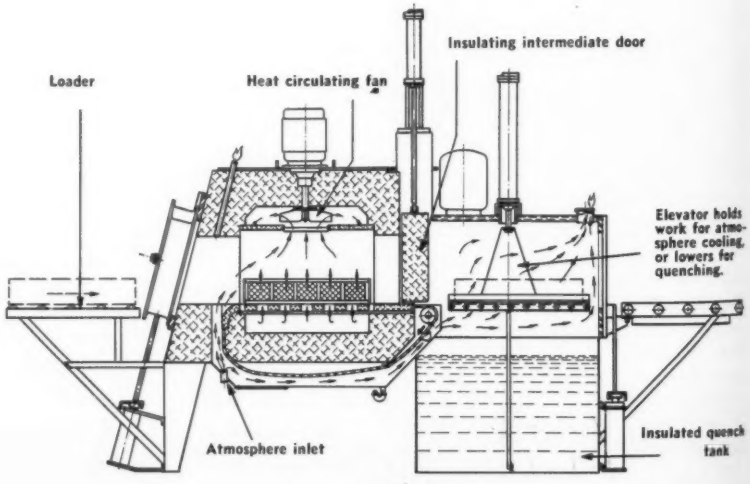


Fig. 1. In this schematic drawing of an Ipsen automatic "all purpose" heat treat unit, parts are loaded, heated by radiant tubes, and quenched.

The proper control of air and gas mixtures throughout the radiant tube is the most important consideration in design. One design is the "dimpled" radiant tube, which has depressions along the wall of the tube. It is claimed that these "dimples" accelerate the flame stream by a dynamic swirling action. The resulting heat dispersal over the entire length of the tube permits temperature uniformity without localized overheating, regardless of the length of the tube. Another modification is the placement of ceramic inserts within the tube, to give a dynamic motion to the flame stream as it progresses through the tube. There are also radiant tubes available with enamel coating to resist the carbon penetration that may occur during gas carburizing.

Due to the increase in the use of controlled atmospheres, as exemplified in gas carburizing and in bright hardening or sintering of the more reactive metals, emphasis is placed on the construction of an air tight furnace, including the muffle design, to prevent contamination of the atmosphere.

Heating With Resistors

Passing an electric current through a resistor is an important method of generating and transferring heat in a furnace. The commercial metallic resistor is either a heat resistant alloy in ribbon or rod form, where the temperature of operation does not exceed 2100°F, or a non-metallic silicon carbide element for use to temperatures up to 2700°F.

Of interest is the development of a metallic resistor that operates at extremely low voltages. Conventional high voltage elements must be enclosed to avoid shorts and failures caused by carbon deposition which may develop during carbonitriding and gas carburizing operations. This problem is eliminated, according to one furnace manufacturer, by using low voltage elements. The heavy, large cross-section element has insufficient potential to ground or short out if carbon deposition occurs. The watt density, which is about 5 watts psi, permits the elements to function indefinitely under very difficult service conditions.

Batch type resistor furnaces include box furnaces, elevator furnaces, car bottom furnaces, and bell furnaces. Continuous resistor furnaces include the conveyor, rotary, hearth, and roller hearth types.

Mechanized Material Handling

Improvements in furnace design have been accompanied by the ever increasing use of mechanical handling devices, for charging material into the furnace, conveying this material through the furnace, and finally, discharging and transferring the work to subsequent operations. Many different loading mechanisms are utilized, with the specific choice depending upon the time cycle used, and other factors such as size, shape, weight and volume of work required per unit time. These same factors also influence methods of conveying the work through a continuous furnace. Devices used include the shaker hearth, roller hearth, walking beam, and conveyor belt. Discharge and transfer equipment often facilitate material handling, too. These may be automatic and, particularly in the entrance or exit of the workpieces into or from the furnace, they are frequently linked with synchronous mechanisms to operate furnace doors and activate flame curtains or other devices that conserve the protective atmosphere within the furnace.

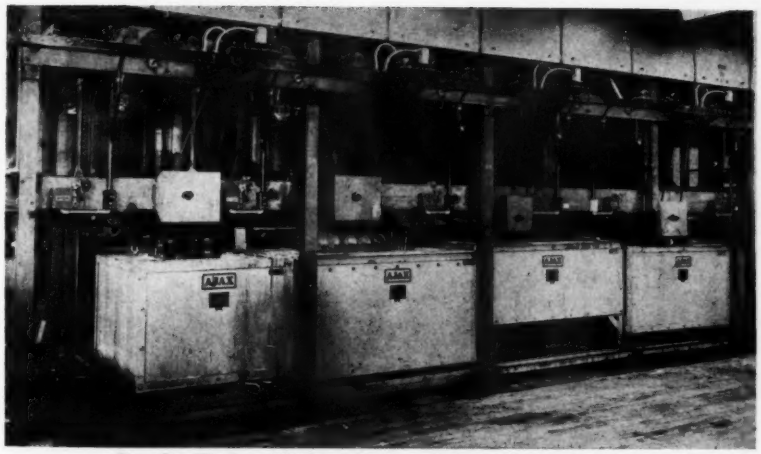


Fig. 2. "Jack rabbit" conveyor salt bath furnaces are used for production martempering of ball bearing races.

Vacuum Furnaces

Another furnace development, although it may be classed as specialized equipment, is the vacuum furnace for heat treating or sintering highly reactive materials.

The properties of metals frequently are influenced by residual gaseous impurities which affect the metal at high temperatures. This is particularly true with many of the reactive metals being used in nuclear, missile, and aircraft applications. Vacuum furnaces operate at a vacuum pressure of a fraction of a micron, which will remove gaseous impurities within the metal. In addition, the absence of an atmosphere surrounding the workpiece prevents undesirable surface reactions to occur during the heat treatment of virgin reactive metals such as zirconium, niobium, uranium, and tantalum.

Heating In Salt Baths

Heating in liquid salt baths is an efficient and accurate heat treating process. A metal or ceramic pot containing the liquid salt is heated and the liquid transfers the heat to the material contained in it.

The use of immersed electrodes, which is a radical departure from the conventional externally heated types, has greatly extended the practical range of molten salt bath equipment. This design has made possible the use of liquid heating for volume production in many heat treatment operations which previously were impractical due to size and temperature limitations.

The electrode designs that are employed are of either the suspended or of the submerged type. The suspended electrodes enter the bath from the top and are usually used with metal pots. This construction is popular for furnaces intended for cyanide hardening, carburizing, descaling, and cleaning.

The submerged electrodes enter through the back wall below the surface of the bath. They are recessed so that the entire working portion of the bath is free from live electrical parts or circuits. This furnace design is used with ceramic pots for neutral hardening, martempering, and austempering; annealing, and hardening of stainless steels; annealing of copper base alloys; heating for forging; and the brazing of both ferrous and non-ferrous assemblies.

As with conventional furnace design, mechanization of salt bath equipment has resulted in greater economy based on greater volume per man-hour. Due to the almost unlimited heat generating capacity realized by close spacing of elec-

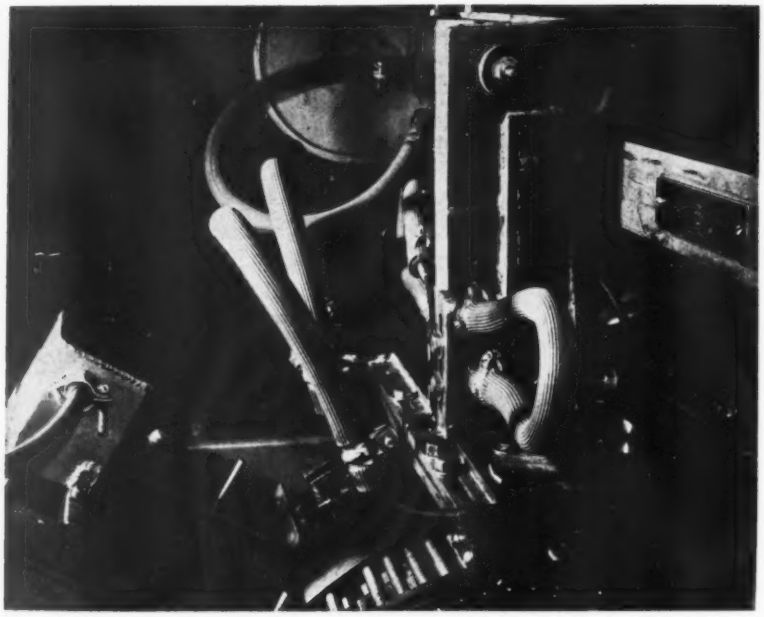


Fig. 3. This 25-kw General Electric electronic induction heater is used in Chrysler Corp's completely automatic line for hardening push rod ends at the rate of 1800 rods/hr. A Ferris-wheel type conveyor picks up push rods and carries them through two "hair-pin" inductors which heat up the last ¼" of metal on each end of the rod. The hot push rods are oil quenched and then leave the bath on a chain-type conveyor.

trodes within the bath, and the fact that a pot of any size, shape, or material can be used, salt baths are now highly competitive with conventional furnace equipment.

These mechanized units carry the work through a series of operations — preheating, austenitizing, quenching, tempering, and washing —to an unloading point, usually in the same area as the starting station. Although there are no limitations as to commercial materials to be heat treated, temperature range, or timing sequence, there are size and design limitations.

Induction Heating

The only requirement that a material must have to be capable of responding to induction heating is that it be an electrical conductor. This method of heating is realized through a transfer of electrical energy from a current carrying conductor, usually referred to as a heating coil, to the workpiece. There is no contact or connection between the two. The coil, a water cooled copper tube, sets up magnetic lines of force that energize the workpiece in such a way as to cause current to flow around its surface. The resistance of the work to this flow causes an immediate heating action to take place. Induction heating equipment is compact and provides accurate, high speed heating for annealing, hardening, and heating for forging and brazing.

For certain adaptable procedures, a quantity of parts can be heat treated by induction heating in one hour as opposed to a full day required when conventional methods are employed. In addition, it frequently serves as a means for meeting hardness specifications which may be difficult to obtain by the conventional methods.

An example is the application of induction heating in the selective hardening of crankshafts. Quenching the crankshafts after processing with conventional heat treat equipment sometimes results in excessive distortion. Subsequent tempering to obtain a machinable hardness frequently results in a surface hardness that does not resist wear satisfactorily on the bearing surfaces. The use of selective hardening by induction solves this problem. This method is used for similar applications, such as treatment of crank pins, main bearings, gear teeth, and axle shafts, where it is not desirable to heat the entire part.

Recent advances within this field include the development of work fixtures that handle parts automatically at intermittent or continuous rates, increased capacity of equipment based on the maximum heat input, and fixturing which permits rapid quenching after the part has been heated to the austenitizing temperature. The three types of power sources that are currently in common use for generation of the high frequency energy required for induction heating, are:

1. Motor generator sets for frequencies of approx. 1,000 to 30,000 cycles with outputs up to 1500 kilowatts;

2. Spark gap oscillator types for frequencies of 100,000 to 400,000 cycles with a maximum output of about 25 kilowatts from commercially available units;

3. Electronic tube oscillators for frequencies of about 400,000 to several million cycles and outputs of usually not more than 50 kilowatts from commercially available units.

It must be emphasized that the purchase of induction equipment requires the same care and study that would be given to the purchase of conventional furnace or salt bath equipment. The choice of frequency is dependent on the design and size of the part. As an example, a frequency of 2,000 cps would permit the selective hardening of a surface to a depth of about 0.125", whereas, a higher frequency of about 200,000 cps would permit a hardness penetration of about 0.020". This suggests that the low-frequency high-capacity generators are better equipped for heavy sections where the hardened area is relatively deep. Conversely, on comparatively thin gears, where the depth of hardening is critical, the high-frequency low-capacity equipment would be preferred.

Advances have also been made in flame hardening procedures. The time honored process of flame hardening has long depended upon individual skill to obtain the desired result. A comparatively recent development which places this method of heating on a competitive basis as to control of process, is the electronic method of controlling heat input to insure a quality product. This method, as a result, is being used more for spin hardening, spot hardening, progressive hardening, and brazing.

Equipment Meets New Demands

The constant need for more efficient and economical production, the increasing use of new metals and alloys, and the requirements for closer dimensional tolerances and improved properties will continue to stimulate new developments in the heat treating field. Improved furnace designs, mechanized handling equipment, automated heat treat lines, and precision control devices are evidences of this progress.

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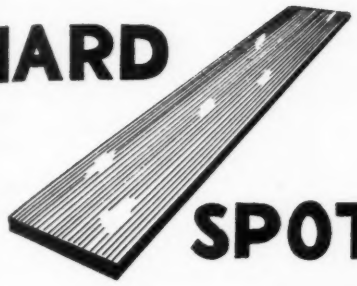
HARD SPOTS IN THE MACHINED SURFACE



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AFTER FINISH MILLING OPERATIONS we can sometimes find pieces which have a surface covered with bright and glittering spots, oriented in milling direction and harder than the remainder of the machined surface. These "hard spots" are believed to be formed in those very points of the machined surface where the cutting edges of the milling cutters did not cut, but slid over the machined surface and cold worked it. The shop men call them "hard spots," due to their hardness, which seems to suggest that they are due to local and excessive hardness existing in the worked material before the machining operation.

The phenomenon of hard spots is usually associated with a rather short life of the applied milling cutters and very often with the chipping of the cutting edges and scuffing marks on the machined surface.

The reported phenomenon is, of course, entirely different from the presence of hard non-metallic ininclusions (e.g. of Al_2O_3), which might exist in steel due to possible errors in its metallurgical processing (e.g. faulty deoxidation with aluminum). Similar inclusions can certainly be detected easily by metallurgical inspectors, checking the steel quality at its reception either in the steel mill, or later in the user's plant. It also should be stressed that such *metallurgical* hard spots result only in excessive tool wear. The spots we are concerned with can be detected *only* after machining and are usually found in a mild or semihard steel, especially if the milling direction coincides with the fibre-lines as a result of the preceding rolling or forging process.

There is certainly no doubt that the presence of such hard spots in the finished machined surface must be avoided by all possible means, not only in order to avoid bad appearance, but also in order to increase the tool life of the applied milling cutters and thus keep down the production costs.

Theoretical Explanation

It is generally known that there exists a limit and minimum value of the theoretical chip thickness (Fig. 1) which can be removed in given machining conditions. If we try to cut a chip of a theoretical chip thickness below this limit, our cutting tool would either cut intermittently, or its cutting edge would be elastically deformed and would slide without cutting, thus cold working the machined surface. The diagram of Figure 1 shows what happens when the theoretical chip thickness is situated above (A) or below (B) the limit value of the minimum theoretical chip thickness.

In the finish milling operations there is a tendency to apply very fine chip loads (feeds per tooth and per revolution) in order to obtain a very fine finish without visible tool traces. In this we forget that the improvement of surface finish through the decreasing of feed value is only possible down to a certain feed value. If we try to apply a feed resulting in a theoretical chip thickness below its minimum value, a feed reduction will *worsen* the surface finish. We should be well aware of the fact that in a conventional slab milling the cutting work of any particular tooth starts with a nil value of the theoretical chip thickness, an opportunity which is helpful in edge sliding. This sliding tendency can only be increased if the milling cutter does not run round, or there is any play in the milling setup. This sliding tendency can be increased by:

(1) High plasticity and ductility of the machined metal, as well as its overheating and striped microstructure, especially if the fibre stripes coincide with the milling direction.

(2) High cutting forces (bad lubrication, low cutting speed, low rake angles).

(3) The presence of play between the workpiece and the cutting tool.

(4) Excessive roughness of the cutting edge, especially if the amplitude of this roughness is very close or equal to the theoretical thickness of the chip to be removed.

We shall attempt, in the following lines, to discuss in detail all these possible trouble causes, and

This report tries to explain how, while machining with feeds too fine, the cutting edges of milling cutters may slide over instead of cut the machined metal. These sliding cutting edges cold work the machined surface and thus form the hard spots.

The very common phenomenon in finish milling steel with hss milling cutters, known usually under the shop name of "hard spots," might not be due to any property of the machined metal, but simply to certain inappropriate working conditions. The hard spots are characteristic; they are bright and glittering and also follow the milling direction.

especially to underline the influence of the ductility of the machined metal.

Chip removal is possible only if the total cutting force is lower than the total force necessary for the cold working of the surface of the machined metal with a (elastically) deformed cutting edge. As we know, the cutting force grows with an increase of the ductility of the machined metal, a phenomenon which is due to an increased coefficient of friction. At the same time, high plasticity makes it easier for the tool to do cold working. That is, the high plasticity leads to sliding of cutting edges and renders successful cutting rather difficult (example: bad machinability of austenitic steels).

The influence of a badly "striped" microstructure, with the fibre lines running in the working direction, seems to be very evident. We would only stress the influence of overheating, resulting in grain growth of the machined material. The grain growth seems to be helpful in creating very intimate contact of rubbing surfaces. The fact that the overheated production pieces usually have an increased tendency to form scuffing marks serves as an example.

All these conditions result, of course, in increased hard spot formation. Hard spots do not exist in machined material before the machining operation and they are not "detected," but simply "formed" by this operation. Their formation is also facilitated by progressive tool wear, because this wear at the same time reduces the theoretical chip thickness and increases the cutting forces by increasing the torque effect of the removed chip.

If, in a milling operation, a single tooth does not cut, but cold works by sliding over the machined surface, the next following tooth is supposed to remove a chip of a greater theoretical chip thickness from a locally strengthened and harder material. In such a way, a hard spot produced by the cold work with one tooth can subsequently produce the chipping of the next tooth, for which the cold worked metal might already be too hard to be cut. The actually increased theoretical chip thickness is already well above the minimum limit and does not allow any additional sliding.

In such cases, the machined surface is very rough. We see scuffing marks and/or sticking of hard spots out of the machined surface, while the edges of the milling cutters might be chipped.

Influence of Cutting Conditions

There is no doubt as to the big influence of cutting conditions on hard spot formation.

The influence of feed per revolution and/or per tooth is very evident in any machining operation, as it controls the theoretical chip thickness. Another important machining factor is evident here in a possible variation of this theoretical chip thickness as a function of the milling method applied. Thus, in a conventional slab milling this thickness grows from zero to its maximum value, while in a climbing milling it starts with its maximum value at the entrance of the tooth inside the material cut, and drops to zero at the exit from the cut. The conventional slab milling method is thus rather helpful in hard spot formation.

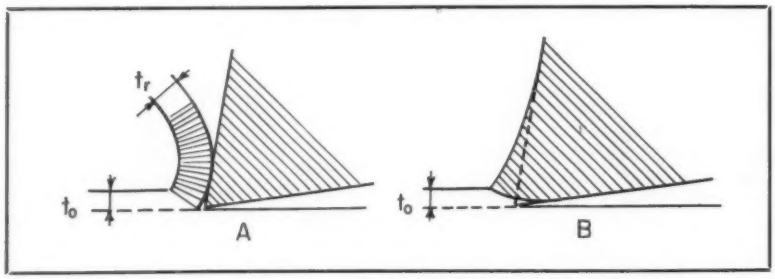

Fig. 1. This diagram shows what happens when the theoretical chip thickness is situated above (A) or below (B) the limit value of the minimum theoretical chip thickness.

Similarly, the lack of rigidity in the clamping of the workpiece and of the cutting tool can also facilitate the phenomenon.

Lastly, a high cutting speed may only improve the cutting conditions, as it reduces the contact duration of rubbing surfaces of both tool and workpiece, reducing the friction* and facilitating the cutting action.

Influence of the Tool Shape

Let us consider first a new tool. We see in Figure 2 a very general chip formation diagram, imagined as if cut with a plane going in the chip flow direction and perpendicular to the cutting edge.

For a new cutting tool the real chip thickness t_r increases with the dropping of the numeric value of the "acting" or "true" rake angle, TRA. An increased chip deformation involves, of course, an increase in cutting forces. On the contrary, an increase in rake angle can only facilitate the cutting action by a drop in chip deformation and in cutting forces.

In its turn, the "acting" or "true" relief (or "clearance") angle, TCA, influences the rubbing action between the relief face of the cutting tool and the machined surface. Its small value increases this rubbing, while its increase reduces rubbing (but *weakens* the cutting edge and makes its deformation and/or chipping easier). In this way, an increase of the rake and/or relief angles may help to avoid hard spot formation.

Any progress of tool wear increases, of course, the tendency of hard spot formation, because it not only increases the cutting forces, but it also reduces the theoretical chip thickness and increases the width of the wear land (on the relief face rubbing against the machined surface).

We spoke above of "acting" or "true" working angles of the cutting edge, as measured in the chip flow plane. Those acting angles result from the angles "ground-in" on the cutting tool. Thus, we talk in *turning operations* of "side rake angle" (SRA) and "axial rake angle" (ARA), and in milling operations of "radial rake angle" (RRA) and "axial rake angle" (ARA), Figure 3. We should note here that the "side rake angle" in turning is practically identical with the "radial rake angle" in milling, and "axial rake angles" are practically the same thing in both machining operations. We should also mention that the "true rake angle," significant in chip formation, results from the combination of applied side or radial and axial rakes.

Influence of the Cutting Fluid Applied

One of the most important objectives of the cutting fluid application, especially in finishing operations performed with hss milling cutters, is the reduction of friction between the cutting tool and the

*The friction is due to a series of alternative pressure weldings of peaks of roughness of two rubbing surfaces with subsequent ruptures of those weldings. This pressure welding is helped by the plasticity of rubbing materials, because this plasticity helps in very intimate contact, without which no pressure welding is possible. The lubrication, as we discuss it later, consists of the interruption of this contact with the help of protective coatings.

machined material, to facilitate chip removal. For a good cut, it is, therefore, essential to cover the surfaces of the cutting edge with an adequate coating of a protective lubrication film, separating these faces from the material cut. Such a film might be either fatty or oily, chemical or physical. It is very evident that the kind of cutting fluid applied and, especially, the mechanical strength of the protective coating produced, are of greatest importance for the chip formation.

Any reduction of friction achieved by appropriate lubrication is very helpful in fighting hard spot formation because it makes chip removal easier than edge-sliding.

It should be mentioned here that in some difficult cases lubrication improvement might also be achieved by the addition of about 2% of an oily colloidal graphite preparation to the applied cutting oil. The colloidal graphite is supposed to fill out the valleys of the tool surface roughness, thus reducing friction.

Practical Conclusions

The above considerations allow formulation of some practical conclusions as to the best method to apply to avoid hard spot formation. We should first of all check whether the actually applied relief angle of the cutting edge is not too small. Very often even a slight increase of this angle would help to cure the entire trouble. We must also keep in mind that a relief angle which is too small can be caused alternatively or jointly by faulty tool design or a blunder in tool grinding.

The next step would be to check cutting conditions — cutting speed and feed per revolution and per tooth ("chip load"). It is also necessary to check whether the milling cutter is running round. If the chip load in a final milling operation is too fine, it would seem advisable to maintain the longitudinal table feed (ipm) and to reduce spindle speed slightly (rpm). We can also increase the table feed and maintain or reduce the spindle speed at the same time. Such a step will, of course, increase the amplitude of the roughness of the machined surface (the geometrical peak-valley value), but we should keep in mind that we are not supposed to perform the milling operations with feed values which are usual in grinding. Let us also remember that a good surface finish is expensive and has to be realized only if required, and only with *appropriate* means.

We should stress here that many technical texts and handbooks already advise the use of chip load values which are sometimes several times greater than the values still applied in some too-conservative and obsolete machine shops. The foremen, setup men, and operators have to be aware of the fact that the finish improvement may be achieved by feed reduction only down to a certain limit and that a further feed reduction below this limit (corresponding to the minimum theoretical thickness of the removable chip) would result only in deterioration of surface finish.

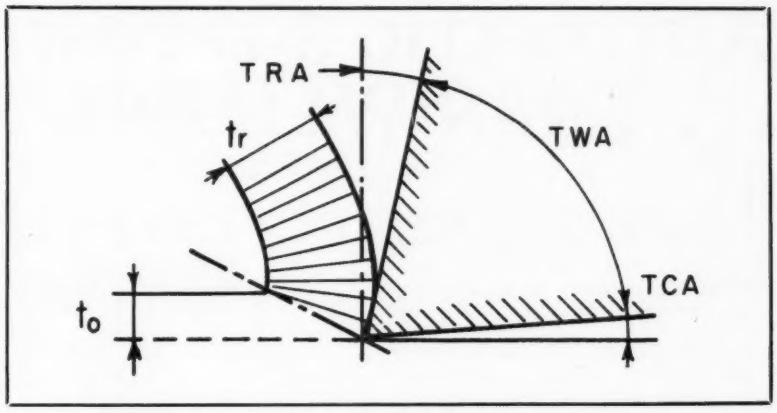

Fig. 2. A very general chip formation diagram, imagined as if cut with a plane going in the chip flow direction and perpendicular to the cutting edge.

Often it is not necessary to undertake complete changes in machining conditions when a slight one might do. We could, for instance, double the depth of cut and reduce the spindle speed (rpm) 15% to 20%, allowing the same or slightly increased table feed (ipm). The resulting finish might be a little worse, but are we *always* sure that this point is of sufficient practical importance? And is the hard spot formation not a deficiency of this finish?

In all roughing operations the problem of surface finish practically does not exist. And in the finishing milling operations we should start by checking the really justified surface finish requirements. (It might also happen that a surface finish treatment such as sand blasting is to follow, so that very fine finish requirement seems rather exaggerated.)

In any event it would seem wise to perform a shop test during production and to submit the machined pieces to the mechanical inspector, who will check the surface finish obtained.

We must not forget to check the selection of the cutting oil, which, if adequate, would certainly help in increasing the number of pieces realized without hard spots per grind. The action of cutting oil can be improved and increased by the addition of different anti-welding agents, such as combined sulphur and colloidal graphite. But, we should first check cutter geometry (as designed and ground). Then check possible improvement of working conditions and cutting oil selection.

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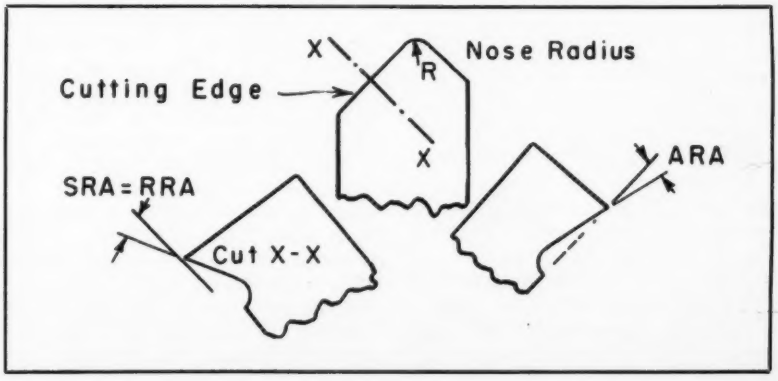
Fig. 3. The "acting" or "true" working angles of the cutting edge, as measured in the chip flow plane.



AUTOMATIC 3-D POSITIONING . . . THEN WELDING

THIS MACHINE is for welding-up the suspension arms of an M-56 tank. When loaded, the fixture holds a complete set of suspension arms for one vehicle.

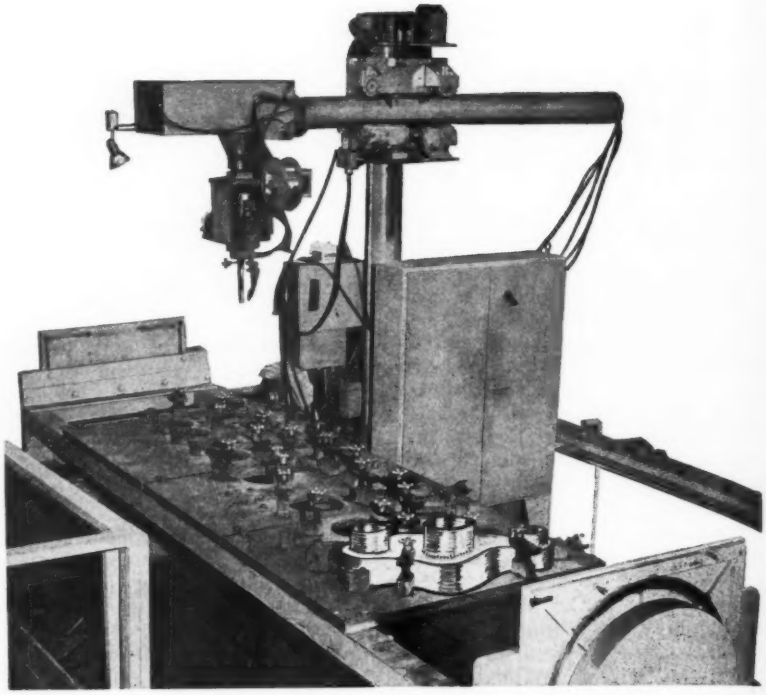
In other words, the machine accepts different shaped suspension arms, each with their bearing tubes projecting out both sides, and then automatically welds them. It is particularly interesting in that location of the bearing tubes is different for each arm.

The welding head, a Hobart constant voltage CO_2 automatic, had to be adapted to permit 360° welds at variable circumferences. It is mounted on a horizontal boom which is, in turn, mounted on a vertical column. The column, along with the power pack, and the control panel are then mounted on a platform which traverses the length of the fixture.

The fixture, which indexes on its trunnion for welding both sides of the part, is automatically controlled and cannot be indexed until the welding head raises to clear the mounted work; when high enough it trips a limit switch to bring about indexing.

A complete cycle welds eight suspension arms, both sides: 10 welds are produced on the front arms; 16 welds on the intermediate arms; and 8 welds on the rear suspension arms. There are a total of 34 welds performed, all circular, varying in diameter from 4" to 9".

Welding is done in a flat-bed position with the head-mounted boom and column on the platform traveling to the workpieces automatically. The boom moves in and out and the welding head comes down, again automatically, to locate the head centrally with the diameter of the component to be welded. Still more programming starts the welding and after revolving 360° to finish weld, the head retracts and travels to the next position. Diameter changes are arranged within the machine before the "automaton" starts its next cycle. This goes on until all parts are finish welded on both sides. This is all done in one setup by the operator.



Workpieces are sizable and since this particular metal must be pre- and post-heated, special small crane handling devices are tied into the master control panel. These permit the operator to load, lock-in, and unload all pieces without danger to himself.

Maximum speed attained in laying-in fillets of ¼" with this machine is 25"/min. The uniformity of the weld could only be brought about by automation which gives an equal bite and contour.

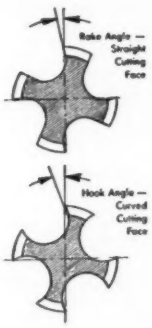
Even at this speed, after many months of continuous operation no shutdowns from mechanical failure have been encountered. It is interesting that this speed produces welds which are 100% free from cracks and porosity — proven by microscopic examination. Undercutting, the user reports, has never been encountered. —WEH

FOUR-STATION MACHINE GRINDS MINING TOOLS

A new four-station automatically-controlled grinder rough and finish grinds head bearing sections of rock bits and similar parts used in the mining, quarrying, and oil industries. The machine handles bit sizes ranging from 3½"-9⅞" and has adjustable fixtures which provide flexibility for a wide range of work.

The grinder, built by Mattison Machine Works, automatically cycles the work through a load and unload station and three grinding stations. After each operation, pieces are automatically gaged and the gaging head signals the machine to feed in as required, insuring that finished work is within limits.

A patented sealed Mattison grinding head of parallelogram design is used at Station No. 2, inclined heads are used at Stations 3 and 4. The sealed precision grinding head incorporates a hydraulic cylinder feed working against an adjustable lead screw stop. Rapid approach and fine feed strokes are provided in this design, both having controllable feed rates and adjustable limits. Lead screw features such as rapid traverse in and out and variable increment jog infeed, make the head unit ideally suited for cycling operations and automatic size control systems. Precision limit switches are included to control and interlock all operations



TROUBLE SHOOTING
Close Tolerance
TAPPING OPERATIONS

TAPPING OPERATIONS SUCCUMB to no firm rules; procedures that work well on one job may not work on another. For any *precision* tapping operation, the best approach is to find the make (they are not alike) and style of tap which works best, then experiment with minor changes in its grind until optimum results are achieved.

For those tapping jobs where new standard taps work well, but costs are high due to their short life, resharpening can be the answer; or experimenting can help you to make certain the as-purchased tap is actually best (not merely usable) for the job. Experimenting is in order and probably is the safest hedge against high scrap rates.

Once new taps, with or without modified grinds, consistently produce acceptable threads, tool life becomes the next consideration. Tap and tap-hole problems often come from using the tap longer than it should be before its removal for sharpening. *Taps have an optimum life before sharpening,* just as drills, reamers, milling cutters and other tools. This optimum life is best determined by experience or experimenting with any particular job. Once established, it is important to remove the tap and replace it or resharpen it before its performance falls off, or the tap is scrapped.

In many cases, a special grind of the tap cutting surfaces is required, and a few simple experiments with various grinds will supply the answers as to cutting edge configurations. All production taps can then be resharpened to this standard, assuring uniform production results.

In general: Taps will cut closer to size with a minimum relief on the chamfer. The hook angle should be determined by the material to be tapped. A slight hook, or none, is satisfactory for cast iron and some brasses. Increasing the hook angle or spiral point will cause freer cutting in steel and aluminum — too much hook may cause chipping.

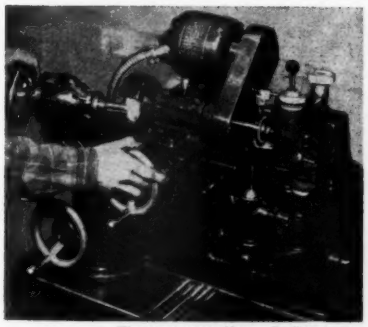
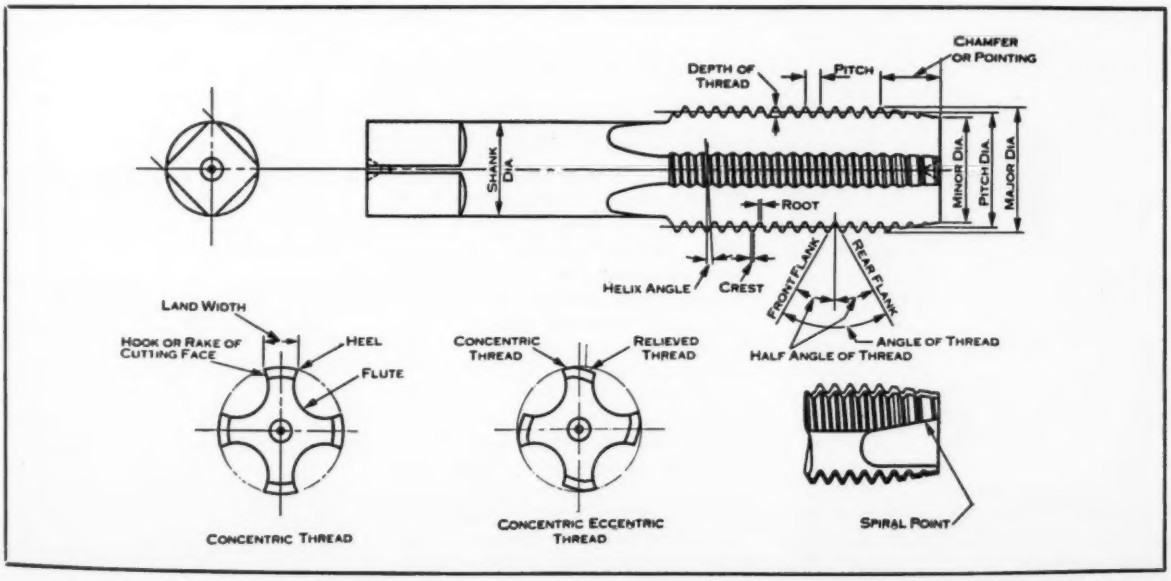


Photo courtesy Henry P. Boggis Co.

Fig. 2. Chamfer sharpening a production tap. This machine can sharpen chamfers (left hand) and flutes or spiral points (right head). On the left head the tap is moved horizontally past its wheel while on the right head the tap is moved vertically past its wheel.

The "Trouble Shooter's Tapping Guide" on the following page, prepared by Henry P. Boggis Co., helps to quickly pinpoint specific tapping difficulties and their "cures."

Fig. 1. Tap nomenclature.



TROUBLE SHOOTER'S TAPPING GUIDE

CAUSE	REMEDY
No-Go Gage Enters Full Length	
Tap cutting oversize	Check PD of tap to determine how much it is cutting oversize. If excessive, consider more hook, less width of land, or a different style of tap.
Taper or bell-mouth	Check spindle and fixture alignment and correct.
Wrong tolerance tap	Use tap with smaller PD.
Poor spindle alignment	Check this, particularly when using tapping head in a drill press.
Too much feed pressure	Correct pressure or use lead screw.
Tap worn on major diameter and cutting oversize	Use new tap. This is a freak situation encountered at times.
No-Go Gage Enters Part Way	
Tap holder not concentric with spindle	Use accurate tap holder.
Go-Gage Enters Only Part Way	
Taper thread being cut	Check alignment of holder and tap.
Lead error	Can be corrected only by new tap with correct lead.
Go-Gage Will Not Enter	
Tap too small	Check PD of tap.
Wall thickness may permit distortion of part	Use roughing and finishing taps, or a tap with more flutes.
Go Gage Will Not Enter	
Fixture may distort light sections during tapping	Reduce clamping pressure or correct fixture.
Torn Threads	
Incorrect hook angle	Tap is pushing instead of cutting thread. Provide more hook.
Wrong chamfer	Increase length of chamfer; this cuts chip load per tooth. Experiment with a spiral point.
Lands too wide	Grind lands narrower on precision machine.
Improperly relieved thread	Use tap with proper thread relief.
Wrong lubricant	Check for correct lubricant.
Material condition	Check hardness; tough, stringy materials tear. In many cases, heat treating to a slightly harder condition will provide a clean, smooth cut.
Steps in Flank	
Improper feeding pressure	Correct pressure or use lead screws.
Torn Crest	
Tap drill too small	Use correct-size drill.

CAUSE	REMEDY
Tap Breaks	
Tap dull	Sharpen on precision tap grinder —not by hand.
Material too hard	Don't attempt materials other tools won't cut. Try roughing and finishing taps for very hard materials or anneal parts.
Incorrect lubrications	Correct lubricant. See that chips or dirt do not interfere with lubricant flow.
Improper alignment of tap and drilled holes	Check drilling and tapping machines, tables, and fixtures.
Drilled holes too small	Correct tap-drill size.
Not enough chip clearance	Grind flute larger. If a long hole, use special tap or rough and finish taps.
Tap not cutting freely	Increase rake or hook in flute or spiral point. Relieved threads may be necessary.
Bottoming in blind holes	Check depth of drilled hole and limit of tapping machine. Don't use spiral taps in blind holes unless hole is deep enough to provide room for accumulation of chips.
Loose or poor fixture	Good taps deserve properly aligned fixtures.
Lubricant does not start ahead of tap	Lubricant flow must always precede tap. A fraction of a sec without oil can cause trouble.
Lubricant does not reach end of tap	Use two streams or pressurize. Use thin, penetrating lubricant, particularly important for horizontal stationary taps.
Grabbing chuck or chatter	Check power and clutches on tapping machine.
Wrong lead screw	On tapping or screw machine, check gearing, cams, etc.
Drag on tap holder	Use tap holder with float lead if ways are not free, particularly with turret lathes.
Not enough thread relief	Try decreasing width of lands.
Not enough chamfer relief	Regrind, not by hand.
Loading of Tap	
Improper lubricant	Correct lubricant.
Improper application of lubricant	Lubricant must reach hole before cut starts. Flood cutting edges of tap throughout cutting and reversing cycle.
Poor flute finish on tap	Regrind flutes—not by hand.
Poor finish on tap flanks	Use properly ground taps.
Improper tap thread relief	Use properly relieved taps.
Tap Teeth Chip Out	
Too much hook	Regrind flutes and/or spiral point to less hook.

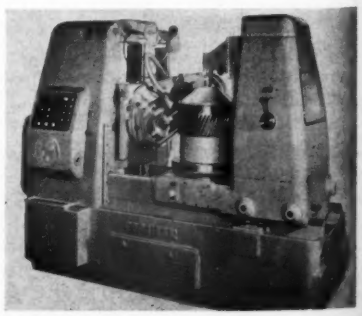
FELLOWS TAKES OVER PFAUTER MACHINE LINES

The Fellows Gear Shaper Company of Springfield, Vt., has arranged to manufacture and market the entire line of gear hobbing and worm milling machines made by Hermann Pfauter, Hobbing Machine Works, Ludwigsburg, Germany. Work has started on one of the gear hobbing machines, with Fellows acting as agent for the remainder of the Pfauter line until facilities for manufacturing in this country are established.

The Pfauter Line is extensive, ranging from the smallest machine with a maximum capacity of 3" pitch diameter, 2¾" face width to one which produces a gear of 120" pitch diameter, 1¼ pitch, and 30" face width.

Many major advances in the field of gear hobbing have been made by the Pfauter Company since Hermann Pfauter originated the universal hobbing machine around 1900. These include such features as the differential for hobbing helical gears, the hydraulic backlash eliminator for efficient climb hobbing, the fully automatic plunge for longitudinal and radial-tangential hobbing, and the latest development, hobbing.

Fellows-Pfauter gear hobbing machines manufactured in this country will conform to American standards and will be serviced by Fellows' nationwide service organization.



Basic Tests of GRINDING WHEEL HARDNESS

THE LARGER THE VARIETY of grinding wheels a company uses, and the larger the number of suppliers involved, the more important inplant wheel testing becomes. Wheel users should develop grading methods and standards for the test methods they use. Old and new methods for testing are discussed below, so the reader can decide which methods are best for his requirements. Under the general methods of tone or sound, density, and penetration, are explanations and comments relative to their use. All methods can be used singly or in combination.

by P. Roy Leaman
Chief Inspector
BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Massachusetts

USE OF TONE OR SOUND

Sonic Testing: The abrasive wheel being tested with a sonic comparator (Fig. 1) is continuously excited, through an electro-magnetically driven stylus, from a calibrated variable frequency oscillator and power amplifier. Vibration is detected through an integral microphone, with provision for a vibration pick-up, if desired.

The wheel under test is placed on the supporting studs and moved back against the vibrating stylus. The calibrated dial of the variable frequency oscillator is tuned by a handwheel until a characteristic pattern appears on the screen of the built-in oscilloscope indicating a fundamental frequency. The dial reading of the calibrated oscillator gives the frequency directly in cycles per second.

Some flaw detection work can be done with this machine, such as testing for cracks.

With the sonic comparator, it is easy to determine when you are on the fundamental frequency of the article being tested and it can rule out harmonics. Some straight mathematical conversions can be made from one size piece to another as long as the grinding wheel specification is the same.

The sonic comparator, in addition, has a wide range (0 to 10,000 cps); it excites the piece continuously so that readings can be pinpointed; it is nondestructive; it gives a numerical reading, and it needs only semi-skilled operators.

Disadvantages are that the readings obtained are the average of the total piece and no study can be done on various areas within the piece.

Stroboconn Testing: This process is similar to sonic testing in that the ring or tone is measured. It takes its name from the instrument used to measure the tone, the "Stroboconn."

The Stroboconn is a direct-reading stroboscopic frequency meter for measuring, visually, a frequency range from approximately 33 cps to 4100 cps. Readings are taken in musical tone and each tone is broken into 100 semi-tones; a typical reading would be G#+35.

The piece being tested is excited by striking it and causing it to ring. Small pieces cannot be tested because the ring or tone is not long enough in duration to register a reading.

The advantages of this machine are that work can be tested rapidly; it is non-destructive; you can rapidly see the variation within a lot of product; it gives a numerical reading; and it can be operated by semi-skilled people.

The disadvantages of this machine include its limited area of application; it can only do larger wheels (generally, 8" dia and larger). And, there is no way of detecting when on a fundamental frequency or a harmonic of that frequency.

Fig. 1. Sonic comparator setup.

Fig. 2. Air gaging setup.

USE OF DENSITY

Density Testing (or weight/unit volume): The product is weighed and measured and the density calculated as in the formula,

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

This non-destructive test method is reasonably fast, and very positive. No operator judgment is required, and semi-skilled operators can handle the work. The method, however, does not tell the hardness of the mass or how well the bonding material has been cured. It gives the average density of the piece only, and it requires mathematical computation.

Sheffield Testing: In this method, air is blown into the product under controlled conditions, and the resistance to the free flow of that air is measured on a four-column Sheffield Precisionnaire (Fig. 2).

The advantages are that it is very fast, and can tell the average pore space and variation within the article. It is non-destructive and requires only semi-skilled operators.

The disadvantages are that surface finish must be constant, and it only tests pore space and not hardness of bonding.

USE OF PENETRATION

Rockwell Testing: This method uses conventional Rockwell hardness testing equipment (Fig. 3). A minor load is first applied, and quickly thereafter a major load is applied and removed. The hardness number is indicated on the dial.

Only ⅛" and ½" balls are used. Table I shows how each size is used. A 60 kg load is used in all testing.

Fig. 3. Rockwell hardness testing.

On vitrified products 50 readings per ⅛" ball are allowed and on other products 450 readings per ½" ball are allowed.

TABLE I

Product Type	Ball Size	Grit Size
Rubber	½"	All
Resinoid Cork	½"	All
Vitrified	⅛"	220 grit & finer
Shellac	⅛"	All

The advantages of this method are: It is fast; it gives a numerical reading of hardness; it can tell the average of the article and the variation within the article; it is non-destructive; and it is a semi-skilled operation.

The disadvantages are limited application because of grit size consideration, and the fact that it does not correlate well to grinding or honing performance.

"Sand" Blasting: This is a method whereby a controlled amount of sand, steel shot, or abrasive is blasted against the piece being tested. It digs a cavity which can be measured for depth or size.

The advantages are that it gives a numerical value of hardness; it can test for variation within a piece; it is a semi-skilled operation; and it can be applied to practically all types of product.

The disadvantages are that blasting materials must be controlled for hardness, and blasting equipment must be closely controlled so that no variation from equipment is caused.

Machine Penetration: This is generally done with grading machines built by the grinding wheel manufacturer because very few commercial machines are available, and each manufacturer has his own thoughts on which design is most effective.

Basically, however, all machines drive a screwdriver-type chisel or diamond into the product under test. They measure the number of turns used to reach a given depth, or are given a standard number of turns and the resultant depth of penetration is measured. Some machines are driven by hand and some electrically with automatic gaging.

The advantages of this method are that it gives a numerical value for hardness; it can test for variation within a piece; and it is a semi-skilled operation.

The disadvantages are that it cannot test products which are in the extreme hard range; chisel size, shape and hardness must be controlled closely; and it is generally destructive on small articles.

Hand Grading (the oldest form of testing grinding wheels for hardness): A skilled operator takes a chisel and digs it into the article being tested. This is done in a rotating manner. He then digs into a known grading standard in the same manner and from the "feel" decides if the product being tested is equal to the known grading standard.

The advantages of this method are that it can be applied to practically all product lines, and it correlates the best with grinding or honing performance of any of the tests used.

The disadvantages are that it relies on operator judgment, skilled operators are a must, and the procedure is generally destructive on small articles. end

INTENSIVE CONFERENCES ON NUMERICAL CONTROL

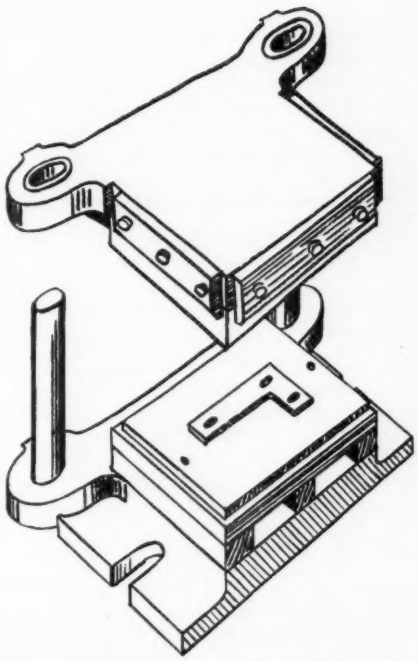
Engineering, production, and management people will get up-to-date practical data on production use of numerical control at two intensive conferences, scheduled for Mar. 22-25 at UCLA and Apr. 7-10 at Purdue University. The same program will be featured at both. For details, contact the Engineering Schools at the respective universities.

READ THIS . . . it can mean beaucoup bucks to you or your company

INEXPENSIVE DIES

. . . and yet what performance ! ! !
Up to 1 ¼" Stock
. . . same die clearance

by William E. Hoffman
Associate Editor



U. S. PAT. NO. 2,850,096
TEMPLET INDUSTRIES, INC.

The use of steel rule dies offers extraordinary savings in die building time, material costs, and press setup time. Information herein is to help you evaluate dies of this construction in terms of your requirements. It was furnished through the courtesy of the Lakewood Manufacturing Co., Westlake, Ohio, and Templet Industries, Inc., (patent holder on this process) of Brooklyn, N. Y. It shows how to make dies for intricate blanking in less than three days, dies for simple parts in a few hours, dies of simple construction that can be used as permanent tooling, dies so inexpensive that several can be made for long runs cheaper than the cost of one conventional die.

These dies can be used advantageously to prove blank developments for permanent tooling, to provide initial tooling to meet first production commitments, and to produce samples for customer tryout and approval.

They can be standby tooling while permanent dies are being repaired, offer extra capacity for unexpected production hikes, save premiums usually paid to obtain extra fast permanent dies, and effect great savings in die storage space.

This tooling can be used to blank, pierce, lance, form, extrude, and emboss most materials. They are usable on paper and plastic as well as aluminum or steel.

General Electric, General Motors, and others are reporting original die cost saving of 70-90%, and at the same time are realizing a 70-80% saving in procurement time.

A STEEL RULE DIE consists of an upper and a lower die section. The major element of the upper die section is a thin band of tough steel—thus, steel rule—which can be worked to any complex contour required. This is supported by plywood. The lower die section is composed of a relatively thin steel die plate mounted on a mild steel adaptor plate.

To start the upper die, plywood die stock is laid out with the outline of the blank and hole locations.

After layout, small holes are drilled for punch locations, regardless of how much larger the final hole diameters are. Using a pilot locator, the holes are opened to the final punch diameters.

The scribed layout is cut out on a diemaker's jig saw using a saw blade smaller in thickness than the steel rule to be used, which insures a drive fit when the steel rule is inserted. Close tolerance die work can be achieved by carefully sawing to the scribed lines.

Steel punches (right) may be driven into the prepared holes for transferring punch locations to the bottom die.

Another step is that of making the steel rule inserts. The steel rule is cut to size with a

hand cutter, and then bent reasonably close to specified radii and contours with the aid of a hand bender and various dies. The sawed-out block form may be used as a master to check progress. After forming, the steel rules are heat treated and driven into place between male and female plywood cutouts.

The plywood die stock is often treated to protect its surface, and pieces of Neoprene are glued in place to serve as strippers.

The adaptor plate is mounted on the bottom die shoe, and located and secured by screws and dowels. The top die section is mounted in Templet's patented die shoe, located by two fixed side plates and, locked up by two adjustable side plates. Now the outline of the top die and the punches may be transferred to the blued die plate by a "hit" in the press.

The lower die plate, now having its impression, is removed and sawed on a metal cutting band saw. Some of the stock is left for final finishing and the holes are opened to desired size. During finishing, the contoured edge may be given approximately a one degree taper.

Then the die plate is remounted on the adaptor plate and Neoprene added for stripping the offal.

Finally, the bottom die section is secured to the die-shoe. With the upper section in place, you are now ready for production.

Thus a die was built requiring only standard equipment with the exception of the diemaker's saw and a hand bender.

The die sets used for steel rule dies are patented by Templet and are somewhat special. They may be procured from the Lempco Industrial Company. (See "Die Set For Steel Rule Dies Boosts Precision and Economy," T&P, Oct. '57, p. 85.) One die set is required per press and will handle all dies within the capacity of that press. Seven sizes of die sets cover most work and they can be left in the press.

So there it is! Dies from readily obtainable materials — steel rules — which come in different heights, widths, thicknesses, hardnesses and types of cutting edges; punch stock, available in all standard decimal and fractional sizes; and the plywood, a die makers' wood with an epoxy binder — made on standard toolroom equipment. These tools produce parts to standard die practice tolerances, in excess of 100,000 pieces. *And* they are so easy to set up or store. end

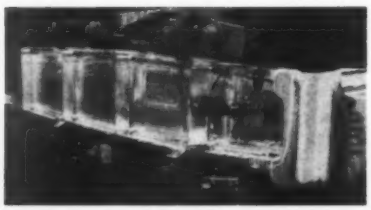
AIR-CLAMP SYSTEM SAVES TIME

A self-contained air clamping system designed into a Keller 3-spindle profiling machine, is used at Chance Vought Aircraft to hold 200 lb forged aircraft wing beams. The use of seventeen air clamps operated by five air valves, saves 40% of the time formerly required with manual wrench-tightened clamps.

Clamps on the 11 ft long aluminum alloy forging can be tightened or released by turning a hand valve, color coded to match the clamps. Clamps are moved as required to permit cutter travel without stopping the operation.

The cutting tool machines the inboard, outboard upper and lower surfaces of both the left and right hand beams. This eliminates the need for a left and right hand tool.

The complete clamping unit can be removed readily to permit milling of other parts. Each clamp is actuated by a two-way air cylinder and operates in a spiral slot in the clamp post, which gives it a 90° movement about the center line of the post.

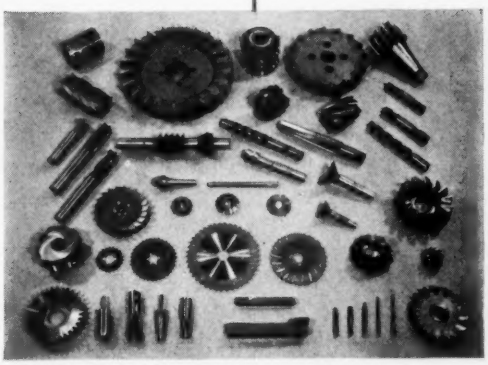


Cincinnati No. 2

Rear left-hand working position is the most convenient for grinding plain helical tooth cutters on CINCINNATI No. 2 Cutter and Tool Grinders.

. . . accurately grinds just about every cutter in the shop

CINCINNATI



Wide range and variety of cutting tools which may be accurately ground on a CINCINNATI No. 2 Cutter and Tool Grinder.

CINCINNATI No. 2's give you the opportunity to attain two desirable objectives in your cutter maintenance program: 1) Cutters of any size and type, ranging from small end mills no bigger than a pencil to heavy 18" diameter face mills, can easily be ground on these machines. 2) Cutters are quickly and accurately restored to top cutting trim. ¶ Check these advantages of CINCINNATI No. 2 Cutter and Tool Grinders against any other equipment within their range:

Anti-friction ball bearing table slide, with hardened and ground ways

Four operating positions, with both mechanical and electrical controls at the operator's fingertips

Vertically adjustable wheelhead pile, with eccentrically mounted wheelhead to gain extra range

There are many other reasons why you should choose Cincinnati for all your cutter grinding requirements. A few are outlined in Sweet's Machine Tool File. More information in catalog No. M-2004. May we send a copy to you?

MILLING MACHINE DIVISION
The Cincinnati Milling Machine Co.
Cincinnati 9, Ohio

CINCINNATI No. 2 Cutter and Tool Grinder

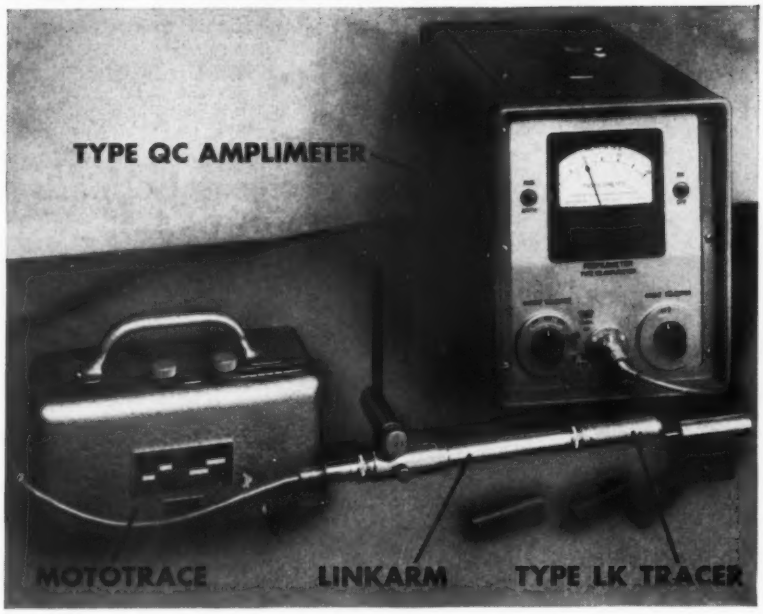
Catalog No. M-2004

CINCINNATI®

KNEE TYPE MILLING MACHINES • BED TYPE MILLING MACHINES
DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 67

NEW! Profilometer® GROUP III



Measures Roughness of Surfaces from 1/8" to Flat — ID and OD

THIS shop equipment handles an exceptionally wide range of roughness measurement—with *proven Profilometer accuracy.* It is lightweight and portable — built for use by shop personnel — and includes the following items:

NEW Type LK Tracer — Measures on ID's and OD's as small as 1/8" — flats — tapers — narrow splines — gear teeth. Passes through a 3/4" hole.

NEW Type QC Amplimeter — Shows roughness from 0 to 1000 microinches (arithmetical or r.m.s.) on an easy-to-read meter. Has 3 standard roughness width cutoffs. Factory-calibrated for dependability.

Mototrace and Linkarm — Give the Tracer a steady support and smooth motion, essential to dependable measurement. No operator skill required.

FREE LITERATURE gives details. Write for it. And, without obligation, let us arrange for a demonstration in your plant. We have representatives in principal industrial centers throughout the Free World.

Remember: You can DEPEND on the PROFILOMETER — first in surface roughness measurement since 1936.

Profilometer is a registered trade-mark.

MMC® MICROMETRICAL MANUFACTURING COMPANY

339 S. MAIN ST. ANN ARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 68

BIG 26" ELECTROLYTIC WHEEL GRINDS BIG BLADES

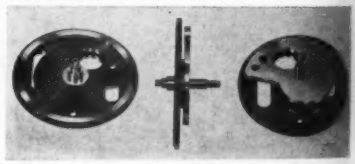
Reportedly the largest of its type, the electrolytic grinding wheel pictured is to be used for machining of the edges of super-alloy jet engine blades. The 1500-amp Anocut electrolytic supply unit is to be connected to a specially arranged machine for feeding the blades, which

have an airfoil section ranging up to 9" long, into the working face of the wheel. Similar equipment for smaller blades is already in production service.

The wheel consists of six pie-shaped segments bolted to a ½" thick stainless steel backing plate. It is a 26" dia metal-bonded non-diamond wheel, weighing 150 lb. The abrasive rim width is 9", and the abrasive section is ¼" deep.

UNUSUAL PRECISION CAM-GEAR COMBINATION TURNED AS ONE UNIT

A cam, shaft, and gear, all machined in one piece from a single piece of 440-F stainless steel barstock, is a component made for use in barometric altitude controllers manufactured by Servomechanisms Inc. These controllers are currently being installed in aircraft and missile equipment.



The open space between the cam and gear is 0.065". In the gear of $2\frac{11}{32}$" dia there are 225 teeth, with a pitch of 96. The tooth-to-tooth tolerance is 0.0002", and the total composite error is held to 0.0007". The cam tolerance is ±0.0001", and the finish is held to 4 micro-inches.

This combination part of camshaft-gear was milled and ground on a machine that was designed, developed, and built by Eonic Inc., specialists in the production of precision cams and cam-shafts.

Announcing NEW

UNIPUNCH PRESS

10 Ton Hydraulic LOW-PRICED

This ALL NEW 10 TON UNIPUNCH PRESS with UNIPUNCH TOOLING punches holes in sheets, angles, channels and extrusions plus notching operations . . . more economically and more efficiently.

UNIVERSAL USE—may also be used for small stampings.

Only UNIPUNCH PRESS has ALL these features:

● Simplicity of design (air-hydraulic) ● Minimum of moving parts ● Operates at 10 tons from 80 lb. air pressure ● 1⅞" ram adjustment ● ½" adjustable power stroke ● Foot operated control ● No double stroking ● 13½" throat depth without gauging ● Gauging from center of ram to the left 24" and front to back 12" (punches to center of 24" sheet) ● Gauging equipped with 7 adjustable stops—additional stops available and attached in seconds ● Optional gauging over 24" available.

STANDARD PACKAGE OF UNIPUNCH TOOLING

standard UNIPUNCH Hole Punching Units including:
38 standard punches for .093" to 2.000" diameter round holes.
76 standard die buttons for 20 gauge to ½" thick mild steel.
UNIPUNCH Hole Punching Unit (for up to ¼" mild steel) including:
5 standard punches for .250" to .500" diameter round holes.
10 standard die buttons for 3/16" to ¼" thick mild steel.
(Shaped punches and die buttons for above also available)
5 x 5 UNIPUNCH 90° Notching Unit:
For notching up to 5" x 5" in 20 gauge mild steel.
For notching up to 3" x 3" in 1/16" thick mild steel.
For notching up to 1¾" x 1¾" in ⅛" thick mild steel.
combination stand, cabinet with drawer and shelf for convenient storage of UNIPUNCH TOOLING and 1 adjustable work light.

UNIPUNCH PRESS and UNIPUNCH TOOLING are an unbeatable combination for *cutting costs.*

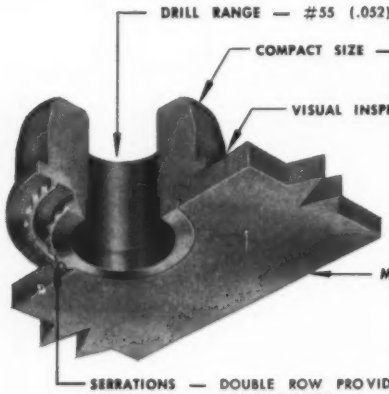
***Write for* ILLUSTRATED CATALOG *and* PRICES**

Showing the *new* air-hydraulic 10 ton UNIPUNCH PRESS equipped with UNIPUNCH Model 12SB-3 Hole Punching Unit and standard 24" UNIPUNCH Gauging.

UNIPUNCH®

PUNCH PRODUCTS Corporation
3804 Highland Ave., Niagara Falls, N. Y.

FOR REAL DRILL TOOLING ECONOMY


DRILL RANGE — #55 (.052) THRU 9/64 (.1406).
COMPACT SIZE — MINIMUM HEIGHT ADEQUATELY SUPPORTS DRILL, DIAMETER PERMITS CLOSE LAYOUT.
VISUAL INSPECTION — WHEN BUSHING IS FULLY INSTALLED, ITS SHOULDER SEATS ON TEMPLATE.
MATERIAL — INSTALLED IN .060 OR THICKER ALUMINUM.
SERRATIONS — DOUBLE ROW PROVIDES POSITIVE LOCK.

Inexpensive Press Type Anchor Bushings are simply pressed into punched (or drilled) holes in .060 or thicker aluminum drill templates and offer durable tooling life for high or low volume production.

The compact sizes of these bushings allow you to lay out very close hole patterns, yet the bushings provide the necessary drill support for perpendicular drilling. The double row of serrations at the base provides a positive lock between the bushing and the template to resist drill torque or template abuse.

To simplify template hole preparation, drill sizes are accommodated by only three sizes of bushings:

AB90 #55 (.052) THRU 9/64 (.1406)
AB91 #27 (.144) THRU "F" (.257)
AB92 #G (.261) THRU 7/16 (.4375)

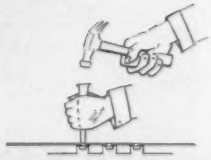
WRITE FOR OUR NEW BROCHURE ON PRESS TYPE ANCHOR BUSHINGS. IT TELLS HOW TOOLING ECONOMIES ARE OBTAINED, GIVES LAYOUT DIMENSIONS, INSTALLATION AND REMOVAL DATA, AS WELL AS ORDERING INFORMATION.

INSTALLATION

1
DRILL OR PUNCH HOLE IN TEMPLATE TO MATCH BUSHING PILOT DIAMETER.

2
PRESS BUSHING INTO TEMPLATE HOLE.

REMOVAL



KNOCK-OUT BUSHING FROM UNDERSIDE OF TEMPLATE.

hi-shear RIVET TOOL COMPANY
2600 WEST 247TH STREET • TORRANCE, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 70

TAPPING PRODUCTION BOOSTED BY DIAL AIR-FEED-TAPPER UNIT

Increased production of a tapping job from 80 to 135 pcs/hr. has been accomplished for a Detroit automotive manufacturer by the use of 12 air-feed-tappers, mounted on two units of six tappers each, and fixturing designed to accurately position the part.

The job is to tap grill trim headers and extensions. The operator loads the part manually then pushes the remote poppet which actuates the

air clamps. The air clamp slide actuates the Keller air-feed-tappers which tap six ¼"-20 holes 0.380" deep in the header. As the tappers return to their start position they actuate the air clamps, thus releasing the part for unloading by the operator.

The cycle for this dial-controlled tapping machine, built by the Keller Tool Division of Gardner-Denver Co., is 12 sec and the tapping is performed after the part has been chrome plated.

VACUUM IMPREGNATING MOVING PARTS WITH TEFLON CUTS WEAR

A low-cost process has been developed whereby moving parts of all types, flat or curvilinear, are Teflon impregnated to eliminate initial starting wear.

All metal surfaces are microscopically porous. When they are thoroughly vacuum impregnated with Teflon, however, the Teflon provides a self-contained lubrication for these parts. This impregnation eliminates the possibility of initial starting damage if additional lubrication is needed to carry on.

The new vacuum impregnation process is a development of Western Sealant Co. Teflon is actually bonded into the metal as an integral part of it. It cannot bleed out under friction, friction heat, or pressure. Such vacuum impregnation can make castings pressure tight up to 15,000 psi,

SPEED KING® *"plug-in"* CONTROL VALVES

reduce assembly and maintenance time

Model PA-121

Built-in plugs and connectors in Valvair's new ¼ in. Speed King 4-way control valves complete electrical circuits *automatically*... reduce assembly and maintenance time to a cost-cutting minimum! Permanent electrical connections are made in manifold or sub-base at assembly... then valves and pilots are plugged in... bolted down. There's no need to disturb equipment wiring for quick in-service maintenance!

Navy M bronze and stainless steel components assure 20 million cycle-plus dependability. Interchangeable pilot, with coil guaranteed against burn-out for life of valve, fits any plug-in Speed King. Coils for ac or dc, any voltage ... 35—200 psi range... optional manual override... ¼ in. cylinder ports... 2 or 3 station manifold with common inlet, exhaust and conduit ports, or sub-base mounted... valve meets JIC standards!

Whether you build or operate machines, you'll find that Valvair plug-in control valves set new standards of adaptability, performance and economy!

Write for Bulletin D-58. Address Dept. TP-359, Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio

Representatives in Principal Cities

Valvair AKRON 11, OHIO

Other INDUSTRIAL DIVISIONS of IBEC. The Sinclair-Collins Valve Co The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

8000

CIRCLE INFORM-A-GRAM KEY NO. 71

ALL NEW . . . through and through!

*Also available as a self-contained driving head for use in specially designed assembly machines.

The DPS model U power screwdriving machine

Manufacturing assemblies with small parts? Take note! Detroit Power Screwdriver Company announces the totally new Model U—quickly adaptable for fast, clean driving of screws, nuts and studs.

Scores of advances! An adjustable clutch designed to hold constant driving torques. A hopper drive with built-in slip control to accommodate shock loads. A feed track with quickly adjustable covers, and an escapement mechanism with positive solenoid action permitting release of screw by body or head.

A new folder, too. Write for your copy today.

DETROIT POWER SCREWDRIVER COMPANY 15,033

2827 W. Fort St. ● Detroit 16, Michigan

A Subsidiary of Link-Belt Company

CIRCLE INFORM-A-GRAM KEY NO. 72

depending on their design. Rejects due to microporosity are eliminated.

Outstanding advantages of the Wesco process are: Machine tolerances are not affected and impregnation does not affect plating or anodizing, which may be applied after castings are treated. No visible sign of impregnation can be found even under closest examination. Vacuum bonding of like or unlike materials can be accomplished at the same time they are impregnated.

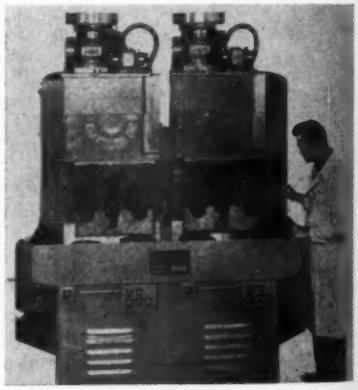
Impregnation allows the use of thinner, lighter walls where weight is a serious consideration. This is the reason for the great use of the Wesco process for missile and aircraft parts.

After impregnation, castings are cured in a dry heat oven. Then, following curing and cooling, they are pressure tested by immersion in water or suitable solvents. Extremely high strength bonds can be achieved at amazingly low cost by this method. Wesco licensee plants are located throughout the United States.

VERTICAL BORER USED ON SMALL AUTO PARTS

Cam-actuated precision vertical boring machines, capable of heavy cuts on castings and forgings as well as precision cuts of less than 0.0005" tolerance on finishing operations, are used at a major automobile transmission plant.

The machines, built by the Hoern & Dilts Div. of the New Britain Machine Co., have a ductile cast iron head supporting a vertical slide and cross-slide, which ride on preloaded



roller bearings. The tool slides are actuated by a pair of cams mounted on a common shaft which is carried with the vertical slide. Cam change takes less than 10 min.

Clean sides of the head and base assembly allow a number of completely independent units to be placed side by side and to be serviced by one operator.

Drill or Bore "TOUGH ALLOYS" Easily

YOU CAN SAVE

up to 70%

DRILLING TIME WITH...

BEDFORD'S

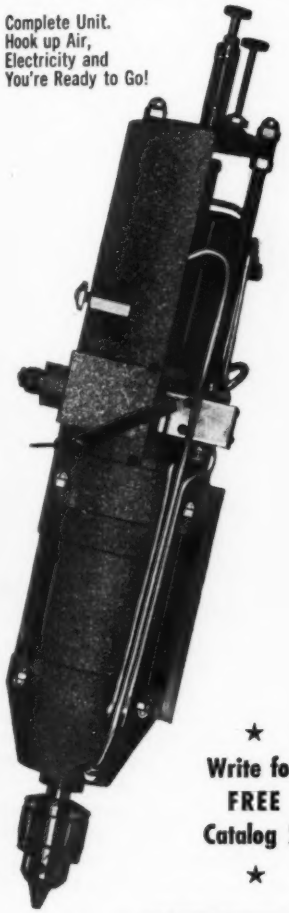
"Rotorized Spindle"

DRILLING UNIT

- MOST RIGID SPINDLE BUILT.
- CONSTANT SPEED and TORQUE.
- POSITIVE EVEN FEED.
- COMPACT! ..... POWERFUL!

... up to 3 HP in a 6" Frame..
... up to 10 HP in an 8" Frame

Complete Unit. Hook up Air, Electricity and You're Ready to Go!



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CIRCLE INFORM-A-GRAM KEY NO. 731

MORE HEAT TREATING VOLUME

with BASIC "BUZZER PACKAGE"

NO BLOWER OR OTHER POWER NEEDED
... just connect to gas supply

"BUZZER" modern gas-fired heat treating and melting units give you the most dependable, economical and productive system for turning out quality jobs at low productions costs. When power is off—"BUZZER" stays on the job! Standard and special furnaces, large or small, available to equip your shop to exact requirements.

COMPLETE LINE OF BUZZER REG. U.S. PAT. OFFICE BURNERS FOR CLEANING, RINSING, PICKLING AND SUNDRY HEAT OPERATIONS

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CHARLES A. HONES, INC.

HEAT TREATING EQUIPMENT SPECIALISTS SINCE 1911

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CIRCLE INFORM-A-GRAM KEY NO. 732

ETALON 23C MICROMETER

one piece stainless steel spindle

HARDENED AND GROUND FROM THE SOLID

• Reads to .0001" • Heavy duty tungsten carbide measuring faces • Forged frame • Dull chrome finish on thimble and barrel • Quick acting positive lock • Built for accuracy under the most rugged applications • Furnished in handsome contour case

AVAILABLE INDIVIDUALLY OR IN SETS FROM 0 to 12"
WRITE FOR CATALOG on complete line of precision measure instruments

ALINA CORPORATION

122 East Second St., Mineola, L.I., N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 733

HI-TEMP BRAZING HELPS STAMPINGS REPLACE CASTINGS

A high temperature brazing process which makes possible the use of lower cost stampings in place of investment castings is now being used by Vac-Hyd Processing Corp. for the production of radial diffusers and nozzle rings (Fig. 1) for aircraft engines and turbo chargers. Savings on finished parts run as high as 45%.

Parts are first stamped from heat-resistant stainless sheet with hole-located vanes and then assembled for brazing.

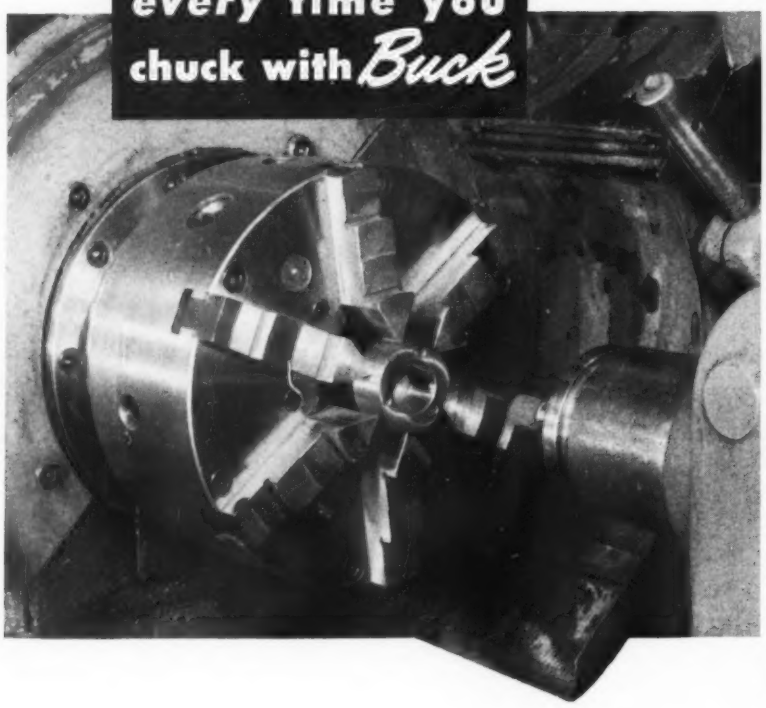
Vac-Hyd uses two brazing methods for parts of this type. One is vacuum brazing, for higher strength or critically stressed parts for special applications, such as missile or gas-turbine engine components. The other method, hydrogen brazing, is better suited for production. It uses

a high temperature material, similar to nickel-base Inconel alloy, as the brazing compound. The brazing paste is manually "spotted" at each joint, and capillary action induced by heat during the joining cycle assures proper material distribution to form complete joints. From 60 to 75 parts are then racked in a sand-sealed retort for the specially-designed furnace (Fig. 2).

The retort is placed in the electrically-heated furnace which is then brought up to brazing temperatures. In this particular application, Vac-Hyd operates the retort at a low dew-point and temperatures just over 2100°F. The parts remain in the pure-dry hydrogen atmosphere for about four hours for complete brazing. Brazed parts are then removed, air cooled and visually inspected.

Fluxes are not required with high-temperature brazing so the process offers clean assemblies to minimize fabrication problems. Any assembly designed for normal brazing can easily be adapted to this process.

YOU make money every time you chuck with Buck



1. You get *dead true* precision chucking single parts—.0005" precision on duplicate parts. (Conventional chucks are only accurate to .003" *when new.*)

2. You save costly machinists' time. Takes but a minute to indicate and adjust a Buck. No fooling around with shims.

3. The Buck Ajust-Tru® principle helps compensate for spindle run-out, compensates for chuck wear—greatly lengthens chuck life.

Buck Ajust-Tru 3- and 6-jaw chucks cost no more than conventional chucks. Send for catalog—see for yourself why "It pays to chuck with Buck."

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY

318 SCHIPPERS LANE • KALAMAZOO, MICH.

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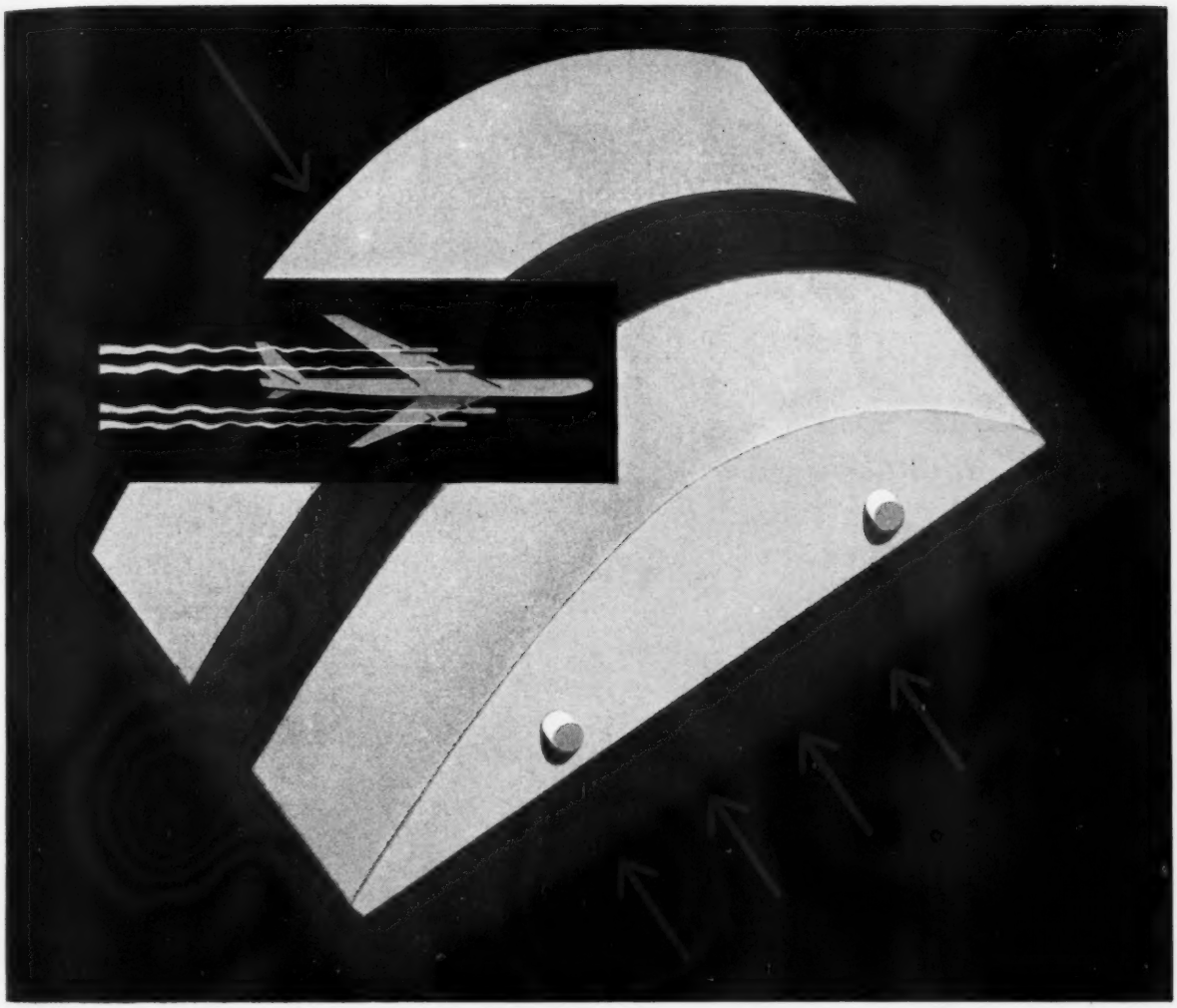

Save up to 30% in cost, 60% in time with EPON® RESIN tools and dies

Your tooling resin formulator will show you how Epon resin formulations save time and money in applications such as these:

High temperature tooling: Metal forming stretch dies that can operate at temperatures over 400°F.

Heated tools: Matched dies, with integral heating units, may be made with Epon resin formulations for rapid heat curing of laminated plastic parts.

Long-lasting metal forming tools: Castings made of formulated Epon resin, mounted in a crank press, showed no permanent deformation after 28,000 compression-shock cycles.

In addition, Epon resin formulations offer you the following advantages:

Excellent tolerance control: Little machining and handwork are required to finish Epon resin tools because of the material's excellent dimensional stability and lack of shrinkage.

Outstanding strength: Jigs and fixtures with thin cross sections can be built from Epon resin-based formulations reinforced with glass cloth. The resulting laminate has high flexural strength and excellent dimensional stability.

Easy modification: Tools and fixtures made from Epon resins may be quickly and easily modified to incorporate design changes.

CONTACT YOUR TOOLING RESIN FORMULATOR

The combination of resin formulator's skill and practical knowledge, backed by Shell Chemical's technical research and experience, has solved many important tooling problems for industry. Your own formulator specialist can help you solve yours. For a list of experienced tooling resin formulators and additional technical information, write to:

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CIRCLE INFORM-A-GRAM KEY NO. 75

Another RCA AUTOMATION Product for Better Materials Handling

Low cost automatic

RCA ROTARY HOPPER

Compare the cost and features of these new RCA Automatic Rotary Hoppers, and you'll see why they are gaining such rapid acceptance! They provide every needed operating feature, yet are offered at remarkably low prices . . . beginning at $265, f.o.b., Detroit.

Features:

- High-speed—up to 20,000 parts per hour.
- Handles cylindrical, rectangular, headed disc shaped and other parts.
- Parts orientation performed by feed track, not the bowl.
- Feed tracks easily changed by loosening one screw.
- 18", 24", 30" bowls available.
- Rugged construction—cast-iron frame; driving mechanism supported by heavy duty self-aligning bearings.
- Standard gear-head motor.
- Safety-slip drive protects parts and equipment.
- Price includes cleats on selector ring and mounting block for tracks.
- Demand-control mechanism and wide variety of discharge tracks furnished at modest extra cost.

Write today for complete information on low-cost RCA Rotary Hoppers. To permit analysis of your needs, send two samples of each part to be handled, and indicate required production rates. Details of other RCA Automation Equipment available on request.

RCA Tmk(s)®

RADIO CORPORATION of AMERICA

INDUSTRIAL AND AUTOMATION DIVISION

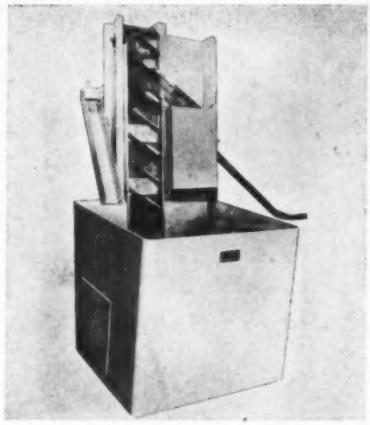
12605 Arnold Ave., Detroit 39, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 761

Products & Processes

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

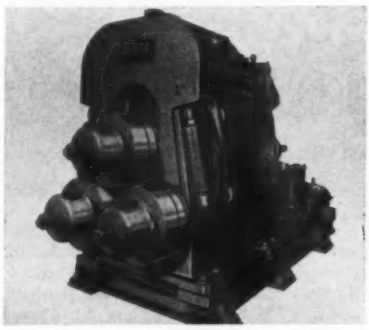
For High-Speed Output, Model 2500-C feeder handles ⅛" to 3" dia and 1" to 6" long sliding parts, and 1" to 5" dia to ⅛" to 1½"



thick rolling parts. Get catalog sheet from Feedall, Inc., 38399 Pelton Rd., Willoughby, Ohio, or Circle Inform-A-Gram No. A1.

The Orchard Inhibitor Paper Manual contains the why, where, when, what, and who concerning rust and tarnishing. Problems and solutions, application charts, and sections on ferrous metal, silver, and copper rust prevention are included. Get your copy from Orchard Paper Co., 3914 N. Union Blvd., St. Louis 15, or Circle Inform-A-Gram No. A2.

This Pyramid-Type Angle Roll Bender accurately rolls materials in a horizontal or vertical plane. Four sizes bend light, medium, and



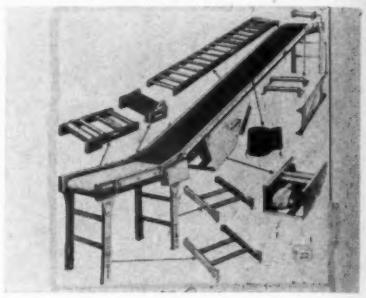
heavy angle sections. For catalog, write Kling Brothers Engineering Works, 1320-32 N. Kostner Ave., Chicago 51, or Circle Inform-A-Gram No. A3.

Speed Large Sheet Metal and Wire Assembly Production with portable gun welders outlined in a bulletin. Directing, scissor, bell crank, push, and rocker types are included. Bulletin G101 from Peer Inc., 1200-1248 Milton St., Benton Harbor, Mich., or Circle Inform-A-Gram No. A4.

New Models of automatic, semi-automatic, and hand-operated rotary marking machines are discussed in a catalog from The Acromark Co., 9-13 Morrell St., Elizabeth 4, N. J. Information on types of feeds and fixtures are also illustrated. Write to the company for your copy of Catalog 9, or Circle Inform-A-Gram No. A5.

Three New Series of Positive-Locking Quick-Release Pins are discussed in a bulletin from D. W. Price Corp., 11161 W. Pico Blvd., Los Angeles 64. The single acting series cannot be released accidentally because the safety chain is on the head and not on the handle. Contact the company for your copy, or Circle Inform-A-Gram No. A6.

Easily Build a Belt Conveyor from these components. Level, inclining, or declining roller bed types of 10", 14", 18", or 22" belt widths



can be made from a variety of straight, "intermediate," and feeder sections, drives, belts, idlers, and floor supports. Information available from The Alvey-Ferguson Co., 3091 Disney St., Cincinnati 9, or Circle No. A7.

A Storage Rack Reference Library contains a 24-page course of instruction on storage rack design and construction and beam load capacities of Standard I-beams, chanel, and pipe. For ideas on how to solve storage problems, consult this literature for case histories. Contact Tube-Strut Corp. 2960 Marsh St., Los Angeles 39, or Circle Inform-A-Gram No. A8.

WHERE TO FIND . . .

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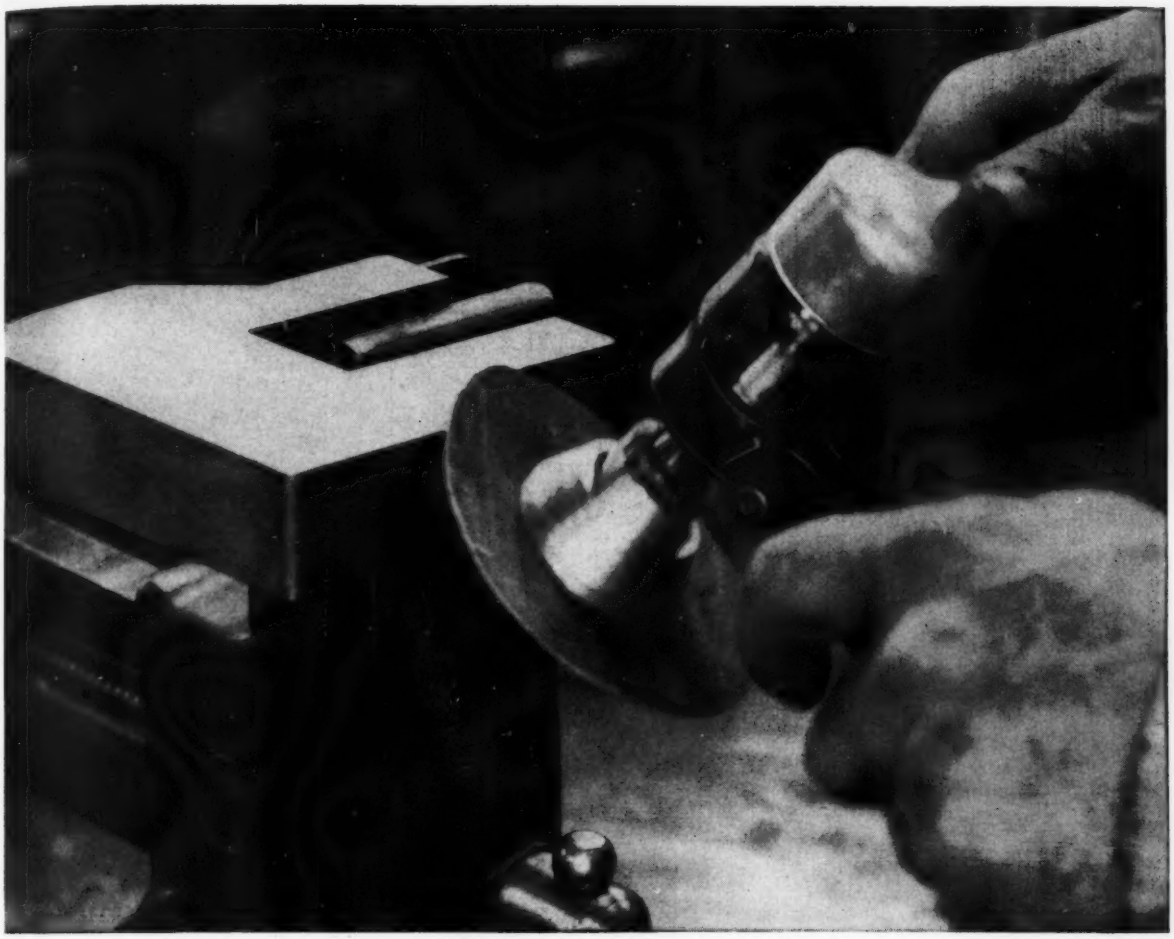


Finishes dies 20% faster... also eliminates abrasive costs

JOB: Putting smooth radius on corners of dies. Formerly used small wheel grinder. Rotor Application Engineer recommended the *right tool*—a Rotor B-02PT 20,000 rpm Disc Sander.

RESULTS: Cut operating time 20%. Light Rotor B-02PT is easier to handle. Gives better finish. Time savings paid for Rotor B-02PT in 12 weeks. Uses 3″ discs, cut down from used 7″ and 9″ discs—a bonus saving of $17.50 per week in abrasive costs.

Why not have a Rotor Application Engineer demonstrate this speedy sander on *your* job. Write for a copy of specifications and Bulletin 53.

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS
CLEVELAND, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 77

Products & Processes

PRODUCTS & PROCESSES & PRODUCTS

A Silicone Carbide Bibliography containing 107 pages, lists scientific literature on the subject. Authors are given alphabetically. Get your copy from The Carborundum Co., Niagara Falls, N.Y., or Circle Inform-A-Gram No. A9.

A Welding Shop Wall Chart with 89 problem-solving specialty alloys and fluxes is available from All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains N.Y. Characteristics and working temperatures are given for aluminum and aluminum alloys, cast iron, magnesium, nickel, and stainless Steel. Circle No. A10.

HELIARC WELDING FILM

"Introduction To Manual Heliarc Welding," an 8-min film, shows how it works and what it can do. Basic pieces of equipment, their relationship to each other, how to make a simple weld, and results of this type of welding are depicted. The movie is on free loan from Linde Co., Div'n of Union Carbide Corp., 420 Lexington Ave., Room 2840, New York 17.

SYNTRON Vibratory

LAPPING MACHINES

provide precision flat surfaces easier, at lower cost — by continuous process lapping and/or polishing

SYNTRON Lapping Machines produce metallographic finishes and precision flat surfaces in production quantities easier and more uniformly than with old hand lapping methods.

SYNTRON Vibratory Lapping Machines work on an electromagnetic principle eliminating all mechanical wearing parts and assuring dependable service with low maintenance.

Available in sizes capable of handling parts up to 35" in diameter.

Improve product quality with SYNTRON Lapping Machines.

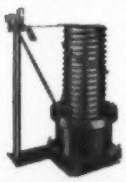
Write for free illustrated brochure

SYNTRON COMPANY
341 Lexington Ave. Homer City, Penna.

Other SYNTRON Equipment of proven dependable Quality

BIN VIBRATORS

BATTERY CHARGERS



TRANSFER AND STORAGE

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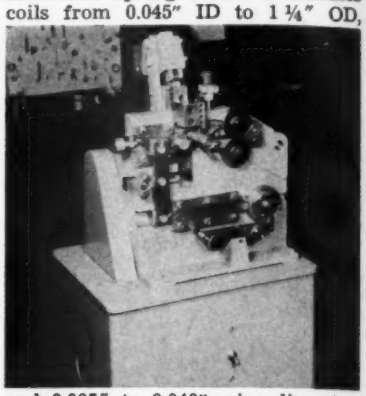
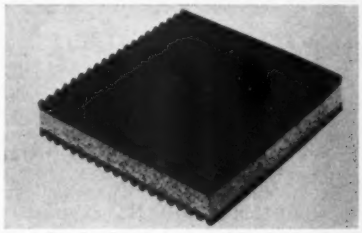
Produce a Wide Variety of Springs with round wire without any special equipment or arbors with the new automatic spring coiler. It handles coils from 0.045" ID to 1 ¼" OD,



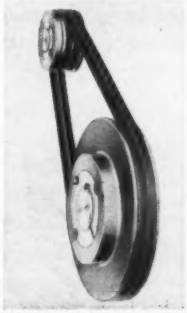
and 0.005" to 0.040" wire diameter. Write to Perkins Machine and Gear Co., Special Machinery Div'n, W. Springfield, Mass., for more information, or Circle No. A11.

Punch Card Machine Tool Positioning and Programming is covered in a bulletin that describes the Shaftrol positioning gearmotor. Applications of the punch card control components to process control systems are explained. The Jordan Co., Inc., 3235 W. Hampton Ave., Milwaukee 9, supplies copies of Bulletin J 200, or Circle Inform-A-Gram No. A12.

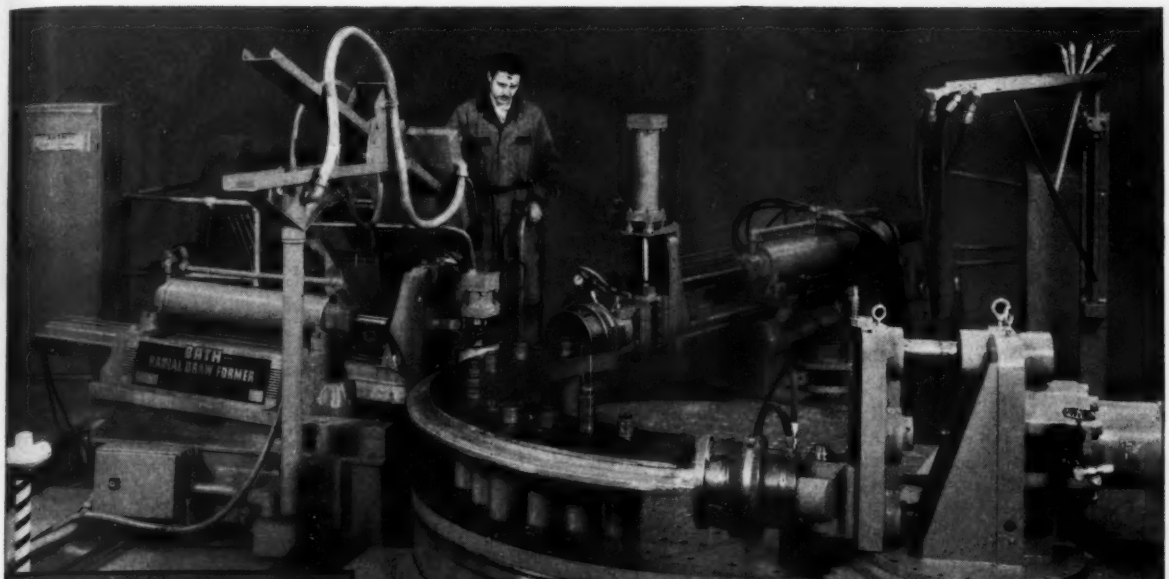
PadZorber Isolating Material was designed for supressing vibration transmission, deadening noise, and preventing machinery or instrument travel. It comes in load ranges up to 3,500 lbs/sq ft and is available in



standard sheets or with isolant or the special cork-like isolating material (shown). T. R. Finn & Co., Inc., Industrial Div'n, 200 Central Ave., Hawthorne, N. J., or Circle Inform-A-Gram No. A13.



A New Line of V Drives reduces size, weight, and costs. Dyna - V drives come in a complete range of horsepower capacities and permit most industrial drives to be handled with only ⅜" wide belts. Belts also come in ⅝" wide. Get bulletin from Dodge Mfg. Corp., Mishawaka, Ind., or Circle Inform-A-Gram No. A14.



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Forming . . . the big missile shapes

In missile plants across the country and in the BATH Contract Forming Division, RADIAL DRAW FORMERS are producing curved shapes for practically all the major missile programs.

The BATH rotary table design and simultaneous *stretch-form* and *wipe-form* techniques yield large, one-piece parts that are both light and accurate. The new BATH yield-tension control offers extreme accuracy even in today's tough metals. Maximum strength is assured and certified in every part formed.

In missile, jet engine and aircraft production . . . where accuracy, stability and producibility really count . . . more and more parts are being formed by the *RADIAL* Draw method. Write for the new catalog number C.F.856 describing BATH Radial Draw Formers or catalog number 32310 describing the facilities of the Contract Forming Division.

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Manufacturers of Radial Draw Formers • Dies • Tools
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NOW! SOLVE DIFFICULT HOLE DRILLIN

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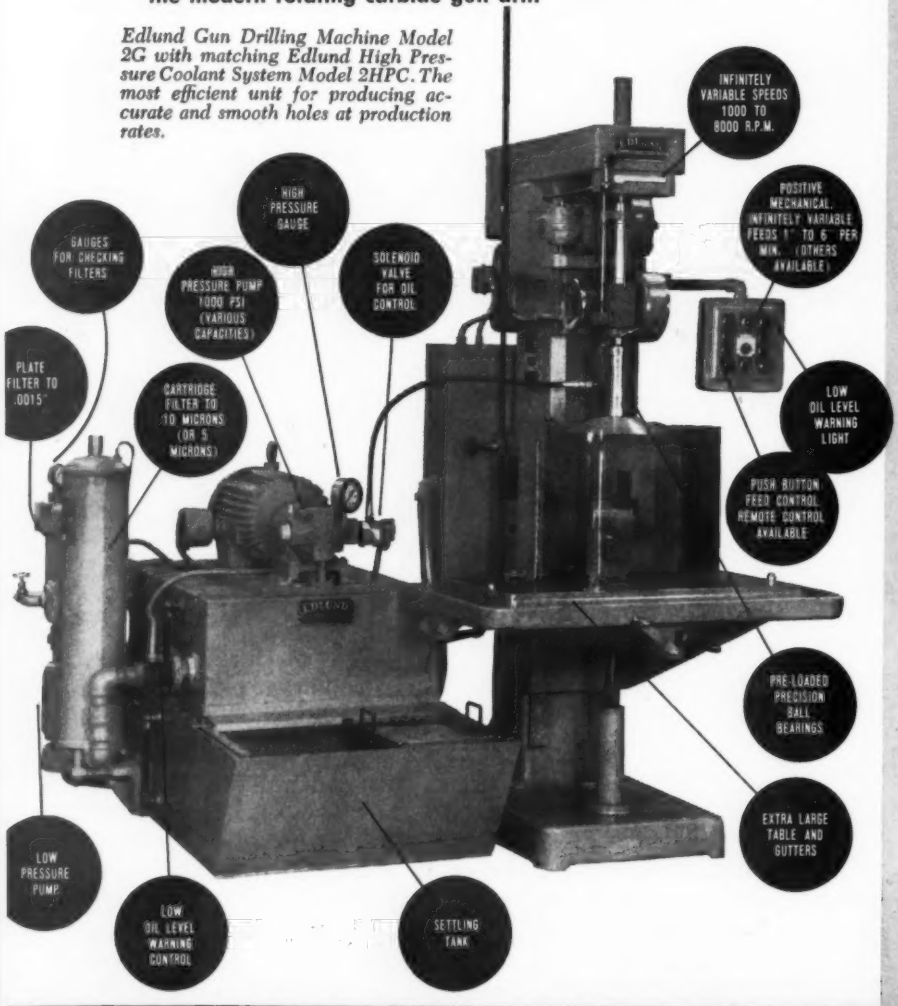
An entirely new and specially designed Vertical Gun Drilling Machine, based on Edlund's years of drilling experience, brings you —

- **The only *Vertical* Gun Drilling Machine for general purpose work**
- **The most economical Gun Drilling Machine on the market**
- **Easy drilling of difficult problem holes — odd shaped pieces, all types of material — aluminum, cast iron, bronze, tool steel, stainless, and other steels**
- **Deep, accurate holes with fine finish**
- **The only machine offering features to utilize the full potential of the modern rotating carbide gun drill**

Edlund Gun Drilling Machine Model 2G with matching Edlund High Pressure Coolant System Model 2HPC. The most efficient unit for producing accurate and smooth holes at production rates.


INFINITELY VARIABLE SPEEDS 1000 TO 8000 R.P.M.
HIGH PRESSURE GAUGE
POSITIVE MECHANICAL, INFINITELY VARIABLE FEEDS 1" TO 6" PER MIN. (OTHERS AVAILABLE)
GAUGES FOR CHECKING FILTERS
HIGH PRESSURE PUMP 1000 PSI (VARIOUS CAPACITIES)
SOLENOID VALVE FOR OIL CONTROL
PLATE FILTER TO .0015"
CARTRIDGE FILTER TO 10 MICRONS (OR 5 MICRONS)
LOW OIL LEVEL WARNING LIGHT
PUSH BUTTON FEED CONTROL REMOTE CONTROL AVAILABLE
PRE-LOADED PRECISION BALL BEARINGS
EXTRA LARGE TABLE AND GUTTERS
LOW PRESSURE PUMP
LOW OIL LEVEL WARNING CONTROL
SETTLING TANK

SPECIAL CONSTRUCTION

Pre-loaded precision ball bea ing spindle keeps thrust a radial tolerances to minimu rigidity of construction throug out to take advantage of t latest development in gun typ drilling.

HIGH PRESSURE COOLANT SYSTEM

Adequate Filtration (Two f ters plus settling tank guara tees clean oil essential for g drilling) *Oil Sight Gauge *Le Level Warning System *Indica ing Gauges and Provision f cooling by water or refriger tion *Capacities—reservoir 1 gals.—pump 10, 20 or 40 ga per min. *Pressures—1000 psi.

FEATURES

- **Infinitely Variable Speeds 10 to 8000 R.P.M. (Others availabl**
- **Infinitely Variable Feeds 1" to 6 per min. (Others available) (DC Motor—Positive Mechanic Control Remote or automatic cyclin available)**
- **Finishes—4 to 8 Micro Inches i most materials (Eliminates Second Operation Reaming, Grinding, Honing)**
- **Capacity—⅝" in steel; Traverse Spindle 8"; Traverse of Table 15**
- **Single or Multiple Spindle Ma chines**

Contact the Edlund Repre sentative in your area or writ direct for Bulletin 2G an complete information on th Vertical Gun Drilling Ma chine.

EDLUND REPRESENTATIVES IN MAJOR CITIES

SPECIAL CONTRACT JOB WORK FOR GUN DRILLING CAN BE ARRANGED WITH EDLUND. SEND PART, BLUEPRINT AND REQUIREMENTS.

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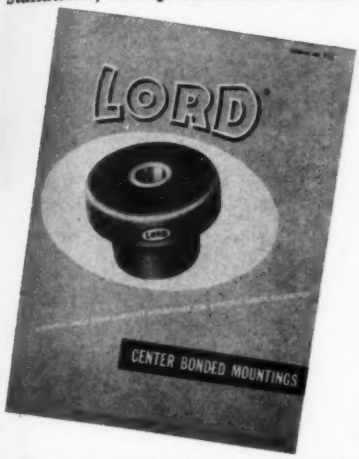
MACHINERY COMPANY Cortland, New York

Division of Harsco Corporation

A Center Bonded Mountings Bulletin gives isolation and heavy shock absorption features. It describes patented design features, installations, and specifications of com-

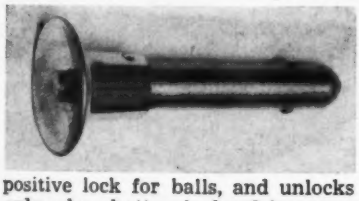


pression-type and shear-type mountings. Get Bulletin 712 from Lord Mfg. Co., Inc., 1635 W. 12th St., Erie, Pa., or Circle No. A15.

Automatic Roll Marker and Manual Marking Devices are pictured and described in a catalog from New Method Steel Stamps, Inc., 147 Joseph Campau, Detroit 7. Several models for automated OD and radial end-face marking are shown. Get Catalog MA-59 from the company, or Circle No. A16.

Aluminum Forging Facilities are described in a 36-page booklet which discusses Alcoa's plant, equipment, products, and services. Properties and kinds of aluminum forgings are also given. For a copy write Aluminum Co. of America, 758 Alcoa Bldg., Pittsburgh 19, or Circle Inform-A-Gram No. A17.

For Shear- and Tensional-Load Applications, use the BB-pins, quick release pins that feature a recessed release button to prevent accidental release. An internal rod provides



positive lock for balls, and unlocks only when button in head is pressed. Obtain bulletin from Waldick Engineering Co., P.O. Box 398, Huntington Sta., L.I., N.Y., or Circle Inform-A-Gram No. A18.

Easy Load Pick-Up is possible with the flat mill-edge blade on heavy-duty Shove-L-Truck described in a bulletin. Photos show applications and features, and dimensions are also in Bulletin ST-14 from Economy Engineering Co., 4511 W. Lake St., Chicago 24, or Circle Inform-A-Gram No. A19.

← CIRCLE INFORM-A-GRAM KEY NO. 80

Chemical Milling Applications, advantages, and design factors are explained in a catalog from United States Chemical Milling Corp., 1700 Rosecrans Ave., Manhattan Beach, Calif. Discussions on what this method is, how it is done, and what metals it can be used on, are included. Get your copy from the company, or Circle Inform-A-Gram No. A20.

"The Basic Concepts of Industrial Material Handing" is a new 16 page booklet that tells what material handling is, its cost and objectives, and how to select proper equipment.

Products & Processes

PRODUCTS & PROCESSES & PRODUCTS

Ask The Material Handling Institute, Inc., Educational Div'n, 1 Gateway Center, Pittsburgh 22, for a copy, or Circle Inform-A-Gram No. A21.

THIN FOIL

Some aluminum foil is rolled so thin that 12 sheets of it would not equal the thickness of a human hair, according to General Electric, which has produced a "tension control" system to keep the foil from tearing as it's rolled out to more than 100 times original length.

5603

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NEW Capacities
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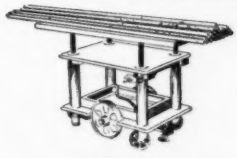
The Handy HAMILTON Portable, Elevating Table



NEW provision for increasing table area!

NEW provision for raising and lowering overhanging loads!

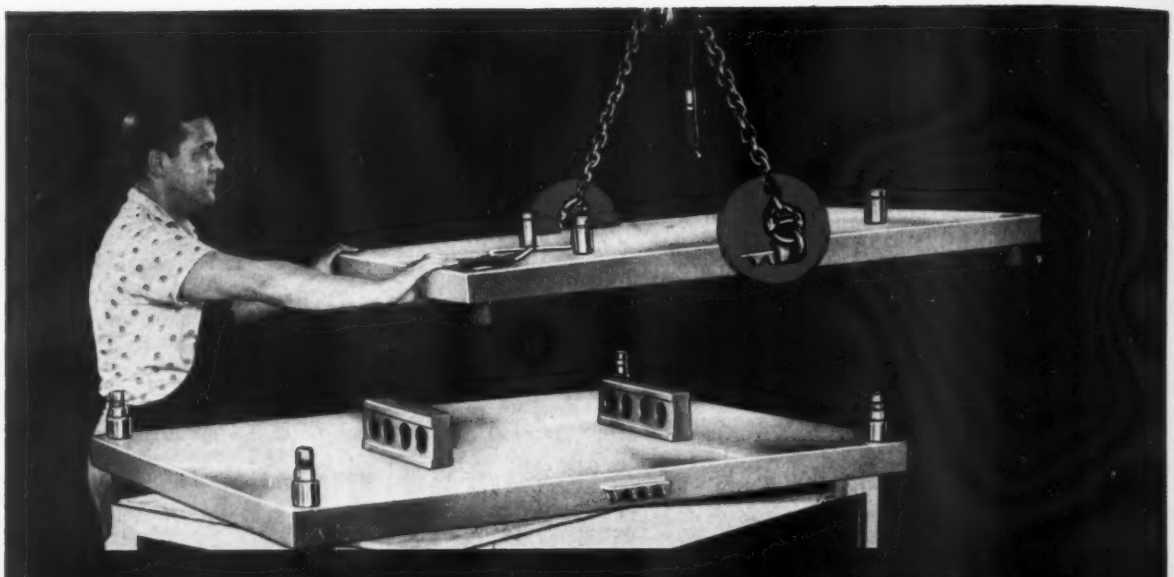
NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

CIRCLE INFORM-A-GRAM KEY NO. 81



LIFT and TURN LARGE and SMALL DIE SETS, QUICKLY, SAFELY

with **SUPERIOR**

LOCK JAW LIFTING DEVICE

Superior's LOCK-JAW is a simple, self-locking wedge that teams with the patented Superior Safety Flanges to permit one man to lift and turn larger sets in minutes — with positive protection for costly dies and human life and limb.

The tendency toward careless blocking is removed when LOCK-JAWS make it so simple, safe and easy.

One of the many exclusive safety and handling features offered ONLY on Superior Die Sets.

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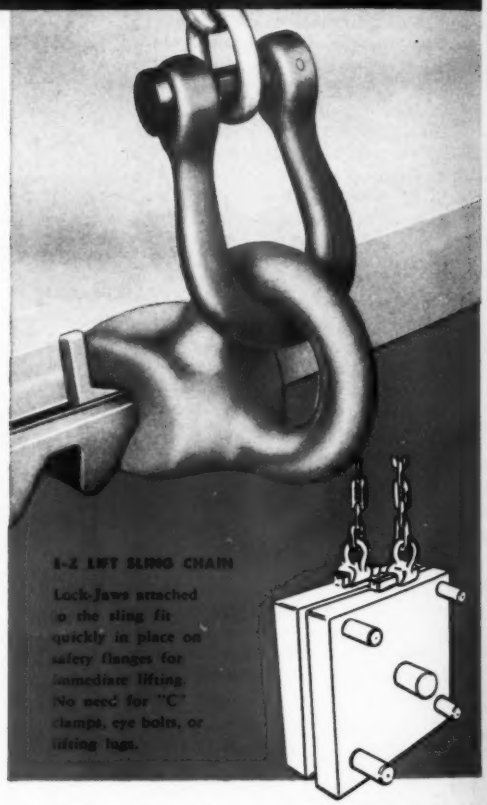
E-Z LIFT SLING CHAIN
Lock-Jaws attached to the sling fit quickly in place on safety flanges for immediate lifting. No need for "C" clamps, eye bolts, or lifting lugs.

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Mitchell 5-6027
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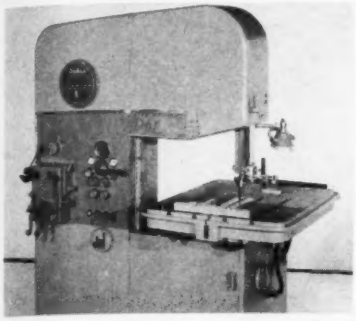
CIRCLE INFORM-A-GRAM KEY NO. 82

Redesigned Contour-Matic Band Machines used in production lines or toolrooms, have a greatly increased average cutting rate. No spacers or adjustments required because new



guide assemblies have carrier wheel flanges that accurately locate saw band. Four models have from 16″ x 8½″ to 60″ x 13″ capacities. The DoAll Co., Des Plaines, Ill., or Circle Inform-A-Gram No. B1.

A Hand Chrome Package provides a complete on-the-spot facility for precision hard chrome finishing of tools and gages. A feature of this hard chromer is that it enables plat-

ing to within 0.0001″, eliminating grinding operations after plating. Literature is available from George L. Nankervis Co., 15300 Fullerton Ave., Detroit 27, or Circle No. B2.

A Large Jig Borer features numerical control, large capacity, tenths precision, and built-in rotary table 48″ dia. A bulletin gives detailed descriptions of operation of Model 4EA and lists dimensions. Get your copy of Bulletin 622 from Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or Circle Inform-A-Gram No. B3.

Standardized Stock Lifters cut time and cost in progressive die construction. Just drill two holes and tap one for retaining screw. To install, drop lifter and spring in one hole and secure it with socket heat retaining screw in the tapped hole. Three styles handle up to 3/32″ thick stock. Detroit Die Set Corp., 2895 W. Grand Blvd., Detroit 2, or Circle Inform-A-Gram No. B4.

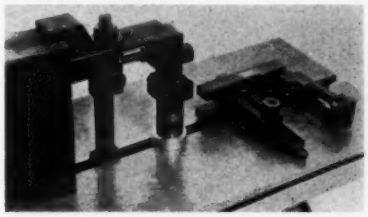
High Quality Surface Grinding at low cost is an advantage of Model 510 surface grinding machine described and illustrated in a bulletin. It details design features and accessories and gives other uses. For your copy of Bulletin GM54, write to Brown & Sharpe Mfg. Co., Providence 1, or Circle No. B5.

A Machine Tool Clamping System starter set contains parts needed for ⅜″ to 11″ clamping range. Adaptable for slotted table or bolsters. Included are U-clamps in two adjustable ranges, extensions, and a gooseneck

Toolroom

PRODUCTS & PROCESSES & PRODUCTS

adapter. Get literature prepared by Hi-Lo Products Co., 8817 Lyndon Ave., Detroit 38, or Circle Inform-A-Gram No. B6.



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The SUPER SENSITIVE, SMALL-HOLE, PRECISION DRILLING MACHINE

With capacity of .004″ to 5/16″ in *all* drillable materials, and spindle speeds from 840 to 9300 R.P.M. infinitely variable in two speed ranges . . . *this* is the machine which the precision industries rely upon to handle the "heart-break jobs."

"*for the finest work you do*"

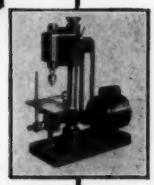
ALSO . . .

Three companion drills, each built to the same accuracy but differing in drive, speed range, and clearances, to cover the full range of special precision requirements.

AND A TAPPER . . .

with capacity from .034″ x 120 to ¼″ x 24 . . . and a "reserve of accuracy."

2488



You will want full information about the Hamilton Line of precision drilling and tapping machines. And we will be glad to furnish it.

Ask for our

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BULLETIN NO. 2488

ADDRESS

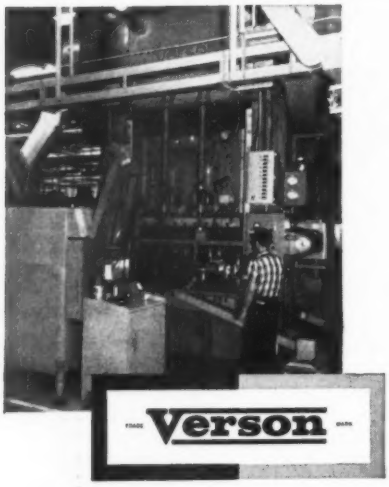
IT'S A Hamilton Tool

USE IT WITH CONFIDENCE

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 83

Are you "whittling" out metal parts that could be IMPACT MACHINED at a fraction of the cost?



If you manufacture machined parts by cutting away sections of a chunk of steel until only a piece of the required size and shape remains, you may be missing an opportunity to substantially reduce your manufacturing costs.

The opportunity is Impact Machining.

Impact Machining is the practical application of the principles of cold extrusion to the manufacture of a wide variety of piece parts that formerly had to be made by metal removal processes or hot forged. In this process, suitably tooled presses cold flow metal into the required shape with little or no conventional machining . . . little or no scrap.

We urge that you investigate the cost cutting advantages of Impact Machining. Ask to have a Verson Impact Machining specialist go over your requirements with you or, for specific recommendations, send drawings and specifications on parts you must produce.

VERSON ALLSTEEL PRESS CO.

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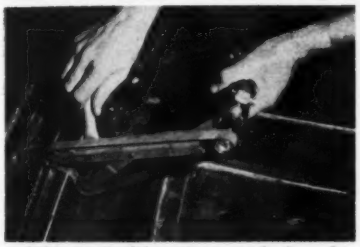
CIRCLE INFORM-A-GRAM KEY NO. 84

Locate and Bore Holes to less than a 0.0001" accuracy with the Model 3 Moore precision jig borer announced in a bulletin. It shows that the greatest possible error of positioning in longitudinal and cross travel

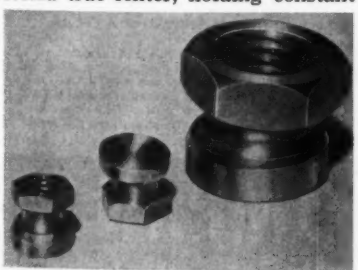
is only 0.00030". Complete specifications and performance data are included in this bulletin, available from Moore Special Tool Co., Inc., 800 Union Ave., Bridgeport 7, Conn.

An Abrasive Belt Radii Finishing Hand Tool produces about 4,000 sfm driven by an air motor running at 17,000 rpm. Finishing of protruding radii and convex surfaces can be done in minutes with this light-



weight tool. It's also good for deburring and de-edging, tool and fixture construction, and tool and die work. Get details from Peterson Tool and Mfg. Corp., Box 513, Okemos, Mich., or Circle Inform-A-Gram No. B7.

Get Quick, Accurate Setups with new toggle pads announced by Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10. They feature a perfected true-center, holding constant



at points of oscillation within 20° in all directions. Request details from Jergens, or Circle No. B8.

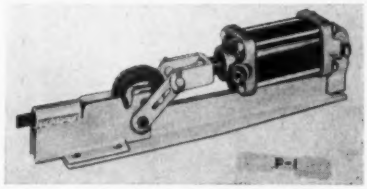
A New Cold Work Alloy Tool and Die Steel with high hardenability, little distortion, and easy machinability is described in a bulletin. It includes technical data on machining, heat treatment, and mechanical and fatigue properties of Lo-Air steel. Universal-Cyclops Steel Corp., Bridgeville, Pa., supplies copies of bulletin TS-101, or Circle Inform-A-Gram No. B9.

Extra Flexibility is a feature of the new Knu-Vise push and pull clamps available in two hand-operated and one air-operated model (shown) for remote control with 85 psi. They have up to 1200 lbs clamping force,

Tooling

PRODUCTS & PROCESSES & PRODUCTS

and built-in deflection provides uniformly tight clamping of parts with normal stock thickness variation. Details are available from Lapeer Mfg. Co., 1150 W. Baltimore, Detroit 2, or Circle Inform-A-Gram No. B10.



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for the
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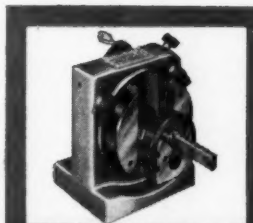
SURFACE GRINDER

Now! Equip your tool-room with the most accurate, dependable surface grinder available. Out-performs many similar makes costing far more. Made by grinding specialists to assure you of superior results—time after time!

- Solid one piece construction of spindle housing and verticle slide.
- Elevating screw centrally mounted.
- Combination "V" and flat ways assure positive alignment.
- Angular rack and pinion face.
- Motorized spindle, dust collector and water unit available.



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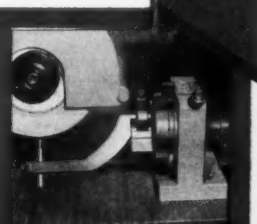
For fast, accurate perforator grinding . . . milling, boring and inspection.



NEW! RADIUS DRESSER ARM
Quickly converts Harig's Grind-All Fixture into a precision Radius Dresser.

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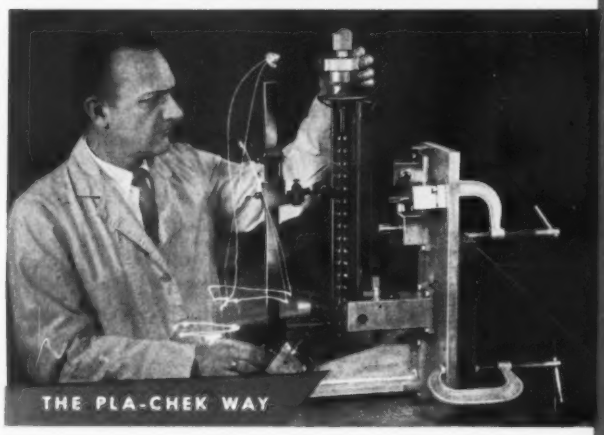
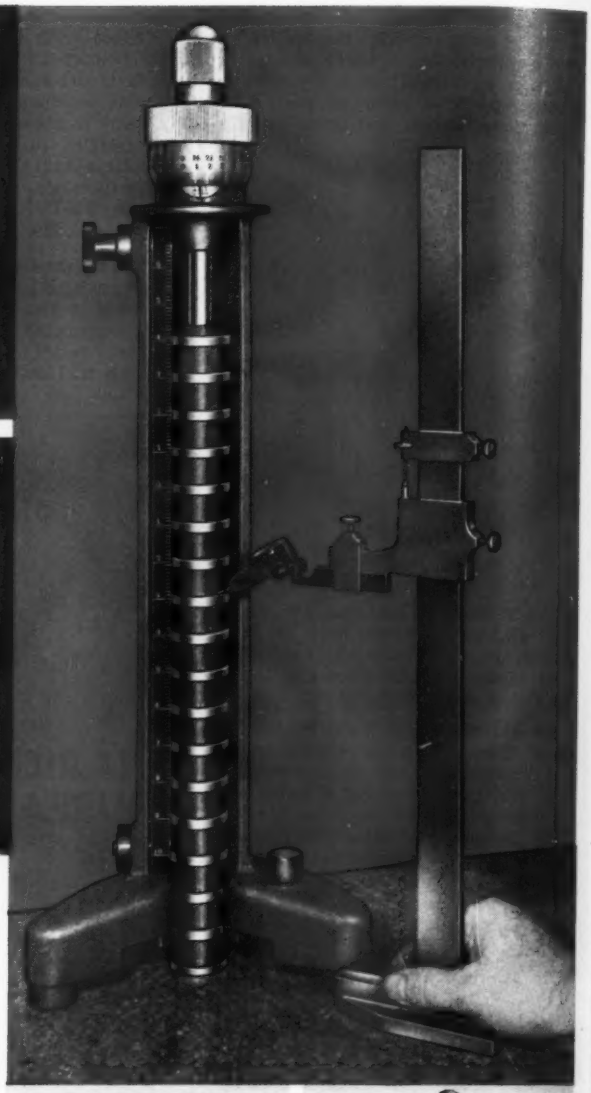
CIRCLE INFORM-A-GRAM KEY NO. 85





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Notice the wrist light photos above. Just a turn of the Micrometer thimble and PLA-CHEK is set. Far fewer motions, far less time . . . and guaranteed accuracy to .00005″ throughout this PLA-CHEK'S entire range. No gage blocks or reference surfaces to touch—body heat can't affect it. Setting time 10 seconds . . . inspections in 1/5 the time of older methods. That speed and accuracy is being proved daily in thousands of installations throughout industry.

There are many other time-saving and money-saving features of PLA-CHEK Gages. Let us tell you about them. Write for complete, detailed literature.

COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6″ and 12″ sizes and the 18″ size (shown above) are guaranteed accurate to .00005″ throughout their entire range, and the 24″, the 36″ and the 48″ sizes are guaranteed accurate to .0001″ in any 24″ length or .0002″ over their entire range.

PRECISION RISERS

Built with the same precision as the gages themselves, PLA-CHEK Gage Risers may be used to extend the usefulness of every PLA-CHEK Gage from the smallest to the largest size. Available in 6″ height for 6″, 12″, 18″ PLA-CHEKS . . . 12″ height for 24″, 36″, 48″ models.

MICROMETER THIMBLE

Is graduated to .0001″ and provides dimensions between 1″ steps on measuring bar. Measuring bar of the 18″ model (as illustrated) and larger models, can be adjusted to enable the user to take readings up or down relative to a center line or other reference line on the work.

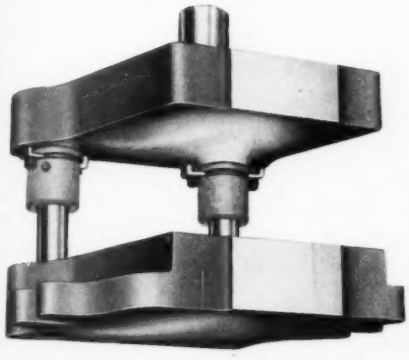
Cadillac GAGE COMPANY

P.O. BOX 3806 • DETROIT 5, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 86

There's Always Something New at DANLY

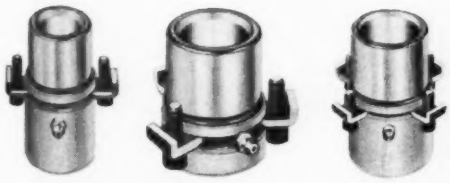
in DIE SETS



New Danly Demountable Die Sets offer you uniformity in a precision fit never before achieved in die sets. Danly Demountable Bushings seat with a tap fit, flush against the ground face of the punch holder with the bore perpendicular to that surface. They are *pre-fitted* in manufacturing so accurately that they are interchangeable. You get 100% bearing every time.

Bushings are easily removed for die work or grinding and returned to proper fit, always. Products of Danly's 36 years' experience, Danly Demountable Bushing Die Sets are stocked near you, giving you fast delivery from a local source.

in BUSHINGS



The New Danly Bronze Plated Demountable Bushings are recommended for use on all Die Set applications requiring high surface speeds, especially with side thrust loads. They are manufactured to the same degree of precision fit as hardened steel and bronze bushings. Factory pre-setting is extremely accurate and reliable . . . lets bushings and guide posts work interchangeably. Available in both shoulder and short shoulder design . . . also in shoulder guide post bushings.

in DIE STOPS

New 5/16" Die Stop completes a full Danly line. Economical, the stop is priced at a fraction of the cost of handmade versions. For easy-to-install, easy-to-use Die Stops, specify the "Big Four" of Danly. They're adaptable to all Dies. Other sizes include 3/16", ¼", and ⅜" bars, with arm extensions from 3" to 6".

in TOGGLES

New easy-grip Kwik-Klamp Toggle Clamp features plastic handle for more comfort and convenience. New fork bar is more versatile, stronger. The new clamps are available with either straight or flanged bases, and with swivel or universal adapters. It is the only toggle clamp available which can be adjusted to any compound clamping angle.

Look to Danly, the leading supplier in the stamping industry, for progress—for all that is new and modern in Die Sets and Die Makers' supplies. Send for information on Dowel Pins, Socket Screws, Bushings and Guide Posts, Roller Stock Guides, etc. Or simply contact your nearest Danly branch or distributor.

DANLY MACHINE SPECIALTIES, INC.
2100 S. Laramie Avenue, Chicago 50, Illinois

DANLY

The leading supplier to the stamping industry
Die Sets • Die Makers' Supplies • Mechanical Presses

RUGGED, LOW COST, AIR-POWERED WORK BRING PRACTICAL AUTOMATION

Any plant, big or little, is made up of "small plants" or separate manufacturing centers. Often these separate centers may consist of only a single machine or operation. Sometimes they cover a group of related operations.

For most plants overall automation is usually out of the question, but every plant can "SPOT-AUTOMATE" these separate manufacturing centers with Bellows "Controlled-Air-Power" Work Units.

These unique power devices turn hand operated or controlled machines into automatic production units; they operate and control hoppers, conveyors, ejector devices, valves, etc.; they provide the power source for fast, safe, inexpensive assembly devices; they are the principal components in an unlimited number of shop-built, special purpose machines.

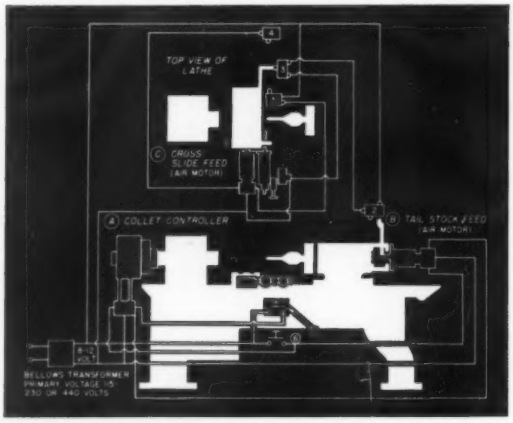
Each work unit is designed for a specific function: rotary or linear work feeders, work clamping and holding devices, rack and gear power feeds, light and heavy duty drill units, hydraulically controlled air cylinders. Each is a complete package in itself with all controls built-in, but all are designed for easy interlock with each other.

Bellows air-powered work units and Bellows "SPOT-A-MATION IDEAS" will give you an entirely new conception of the cost saving possibilities of air power.

SPOT-A-MATION IDEA L-1

CONVERTING A LATHE WITH BELLOWS "CONTROLLED-AIR-POWER" DEVICES

Typical Application of Bellows "Controlled-Air-Power" Devices on a standard lathe to (1) Automatically Close Collet, (2) Feed Tail Stock equipped with Drilling Tool and (3) operate cross slide to feed two form tools.


TOP VIEW OF LATHE
C CROSS SLIDE FEED (AIR MOTOR)
A COLLET CONTROLLER
B TAIL STOCK FEED (AIR MOTOR)
BELLOWS TRANSFORMER PRIMARY VOLTAGE 115 230 OR 440 VOLTS

SEQUENCE OF OPERATION

Operator loads work piece into standard Lathe Collet and depresses start switch (1) which energizes Electroaire Valve of Collet Controller (A), clamping work piece. Start Switch (1) simultaneously energizes Advance Solenoid of Air Motor (B) bringing Tail Stock and Drilling Tool into work piece completing one operation.

As Tail Stock reaches fully advanced position, trip dog of Air Motor (B) actuates switch (2) breaking hold circuit to "Stop Valve Control" of Cross Slide Feed (C) through switch (3) releasing Cross Slide to advance one form tool.

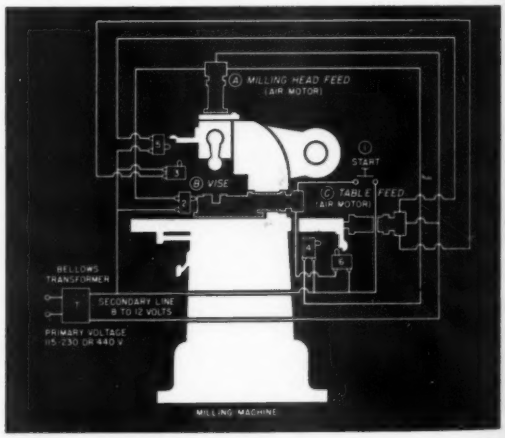
Air Motor (C) is held at mid-point of Cross Slide travel by the "Stop Valve Control" on the Bellows Hydro-Check. This stop action is accomplished elec-

The Bellows Co.
AKRON 9, OHIO

SPOT-A-MATION IDEA MM-1

SEMI-AUTOMATIC OPERATION OF MILLING MACHINE

Typical Milling Machine Application of Bellows "Controlled-Air-Power" Devices to (1) Clamp Work Piece, (2) Feed Milling Head, and (3) Feed Milling Machine Table through the cutting cycle.



SEQUENCE OF OPERATION

Operator loads work piece into jaws of Bellows CVEH-50 Electrically Controlled Air Vise, which have been machined to contour of work piece, and depresses button of Start Switch (1) clamping the piece in position.

The Vise Jaws close and trip normally open Switch (2) energizing the "Advance" Solenoid of Air Motor (A) which lowers the milling head and cutter into work position. When the milling head reaches fully advanced position Switch (3) is actuated, energizing advance solenoid of Air Motor (C) placing the milling table in motion.

Air Motor (C) advances, feeding the table through the cutting cycle, until Switch (4) is actuated. At this

The Bellows Co.
AKRON 9, OHIO

UNITS WITH BUILT-IN CONTROLS TO PLANTS BOTH LARGE AND SMALL

With built-in electrical operating controls*, built-in four-way directional valve, built-in two-way piston rod speed controls—and requiring only a single air connection—this unique air cylinder is the power source for Bellows integrated work units.

These "Spot-A-Mation Ideas" Can Point The Way To Important Cost Savings In Your Plant

Bellows "SPOT-A-MATION IDEAS" give you easy-to-follow drawings, wiring diagrams, operational sequence and list of equipment required to convert drill presses, milling machines, lathes, arbor presses, etc., to automatic units; show how to automate wood working equipment; how to simplify conveyor operation; how to build inexpensive assembly devices; show unique special purpose shop-built multiple drilling machines and other special metal, woodworking and plastic fabricating equipment.

They are free, on request. Write Dept. TP-359, The Bellows Co., Akron 9, Ohio for this new SPOT-A-MATION IDEA FILE. If you have a specific operation you would like to SPOT-AUTOMATE, our Bellows Field Engineer Staff will be happy to work with you. 1220-B

*Controls may be 8-12 volt, explosion-proof, or 115 volt to JIC Standards. Option pneumatically or manually operated controls also available.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 89

Attach this page to your letterhead
and forward for our new 16-page catalog.

CONICAL TOOL CO. 3890 Buchanan S.W.
Grand Rapids 8, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 901

KUTMORE
ADJUSTABLE
HOLLOW MILLS

- Any COMBINATION of . . . Turning . . . Tapering . . . Facing . . . Chamfering . . . Trepanning in ONE PASS.
- Exclusive MICROMETER Adjustment Feature For Rapid Set-Up.
- Area Sales engineers for your immediate Problems.

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PRECISION STARTS HERE

CARL WIRTH & SON, INC.
1625 CLINTON AVE. NO. ROCHESTER 5, N.Y.

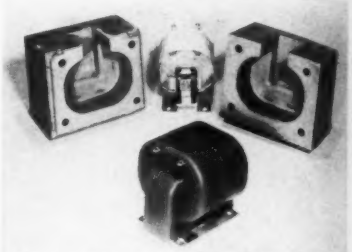
CIRCLE INFORM-A-GRAM KEY NO. 902

Plastics

PRODUCTS & PROCESSES & PRODUCTS

This Epoxy Resin, for casting, laminating, and adhesive uses where high heat resistance is required, is discussed in a bulletin. Resin 617-A is aluminum filled, while Resin 617-C is clear. Both have low viscosity. Features, applications, and working instructions are given in a bulletin from Marblette Corp., 37-31 13th St., Long Island City 1, N.Y. Circle Inform-A-Gram No. C1.

These Single-Component Epoxy Compounds are ready to use without adding hardening agents and offer extended stability at room temperature. The 6700 Series is available in filled and unfilled systems offering several degrees of flexibility and heat resistance exceeding 150° C. Get Bulletin 6700 from Electrical Insulating Div'n, Houghton Laboratories, Inc., Olean, N.Y., or Circle Inform-A-Gram No. C2.



"Liquid Polymer / Epoxy Resin Systems," a 13-page reference manual, shows plastic tooling specifications. Proper methods for selecting and compounding liquid polymers with suitable epoxy resins, curing agents, and fillers are explained. Charts and tables show physical properties. Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N.J., or Circle No. C3.

For Resistance to high temperatures and greater heat stability, use epoxy novolac introduced by The Dow Chemical Co., Midland, Mich. Based on epichlorohydrin and novolac, it also has great chemical resistance. Applications include high strength adhesives for metal fabricating. Get details from the company, or Circle No. C4.

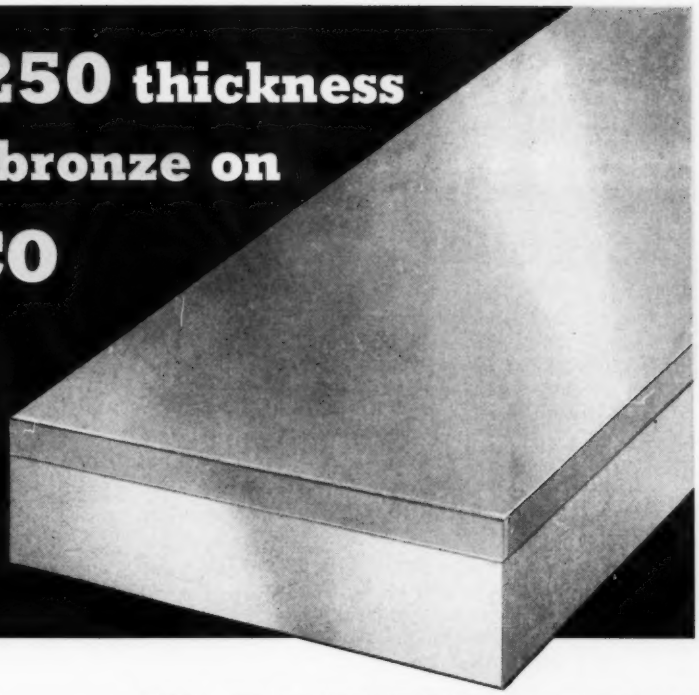
MOVIE BOOKLET

Six films are reviewed in a booklet available from the chemicals and plastics division of Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., 260 Madison Ave., New York 16. Protective coatings, packaging, and development of Tenite plastics are subjects covered.

EPOXY PLATES

Epoxy plastics now can be economically and successfully applied to the manufacture of precision tooling plates up to 20" long. The process is quick and costs only a fraction of precision ground steel surfaces, says Furane Plastics, Inc.

you get .250 thickness of usable bronze on O-KNI-CO clad wear plates



no other wear plates now offer this tremendous advantage

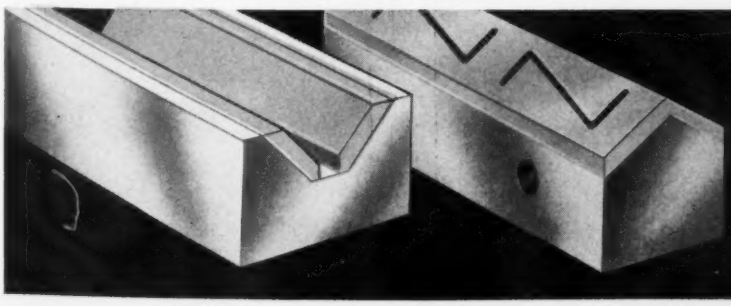
O-KNI-CO clad aluminum bronze wear plates are a combination of 1/4" thick aluminum bronze eternally clad to a tough, easily machinable steel backing. Unlike ordinary thinly coated products, O-KNI-CO clad aluminum bronze wear plates deliver phenomenally long wear. Their steel backing gives great strength. You receive them completely finished, ready to install. Available in 14 standard cross sections from 1/2" to 1 1/4" thickness, 1 1/2" to 8" width, up to 72" length. Special sizes furnished to your requirements. Drilling and counter-boring can be done through bronze if required.

Their many applications include use as slides in cam and trim dies, or wherever there is a sliding action between flat metal parts. Hundreds of machine tool builders and users are enjoying the many advantages of O-KNI-CO aluminum bronze wear plates. If you are contemplating using bronze wear plates it will pay you to consider the many, many dollars you will save in replacement costs alone when you purchase long wearing O-KNI-CO .250 thick bronze wear plates. If you are now a user of solid bronze wear plates, O-KNI-CO offers you approximately 40% savings in initial cost alone and delivers the same performance. Immediate delivery available on standard sizes. Data Sheets illustrating applications are available by writing Dept. 79-LL.

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES
SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS



Also in wide usage are O-KNI-CO Clad Aluminum Bronze Ways and Gibs. Ideally suited to run against O-KNI-CO Hardened Ways.

CIRCLE INFORM-A-GRAM KEY NO. 91

faster . . .
easier . . .

TEMPLATE Assembly...

Drop a PEM Self-Clinching Drill Bushing into each on-center hole and apply squeezing pressure (with any standard press).

Template's finished.

That's how fast, easy, cost saving, PEM Bushings make Template production.

There's no riveting, welding, indexing, nesting, no outboard supports necessary. There's no chance for bushings to "cock" during installation.

Compression-clinching provides torque and push-out resistance far in excess of needs. Permits use of thin gauge, light weight templates (one-third conventional thickness).

Find out how PEM Bushings save their cost—plus a profit to you—in simplified assembly. Write for literature and sample for trial.

PEM

DRILL BUSHINGS

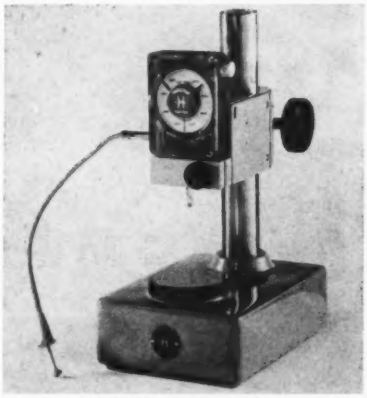
PENN ENGINEERING & MANUFACTURING CORP.
DOYLESTOWN, PENNSYLVANIA

CIRCLE INFORM-A-GRAM KEY NO. 921

Inspection

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

The Kwick-Check Instrument Line now includes a precision dial comparator and micro dial indicator gage. The dial comparator (shown) features direct reading in 0.00005″,



range of 0.004″, dual gaging contact pressure, and fine adjustment on both stand and gage. Get information from The Industrial Div'n, Hamilton Watch Co., Lancaster, Pa., or Circle Inform-A-Gram No. D1.

"Gaging Threads for High Reliability . . ." is a 20-page catalog featuring Tri-Roll thread comparators. Advantages, specification charts, types of gage rolls, and detailed explanations and illustrations are given for setups and for analyzing readings. Get Catalog 606 from Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn., or Circle Inform-A-Gram No. D2.

A High Precision Block Level features side openings for vertical and horizontal observations, bubble tube protection by cover plate, and adjustable ground bubble tube. Three

degrees of sensitivity and four lengths from 6″ to 12″ are available from Opto-Metric Tools, Inc., 137 Varick St., New York 13, or Circle Inform-A-Gram No. D3.

Long Range and High Magnification are possible with four new Series L Testmaster models. They're equipped with extra long contacts for deep hole exploration in jig borer and surface plate applications. The 0.080″ ball tip contacts are either 1.446″ or 1.497″ long, depending on model. All are graduated in 0.0005″, have total 0.080″ range, and come in horizontal or perpendicular

types with regular or large (1⅛″ dia) dials. Federal Products Co., 1144 Eddy St., Providence, R. I., or Circle Inform-A-Gram No. D8.

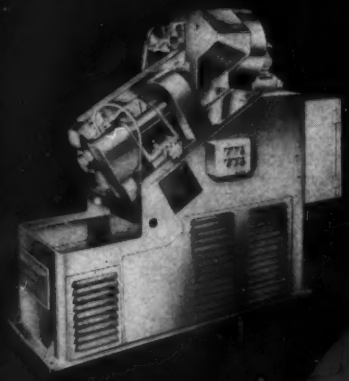
For Greater Accuracy and Easier Use, use the improved precision tools described in a bulletin. Information is given for convertible thimble micrometers with 0 to 1″ by 0.0001″ range, height gages, Super Hite Check that reads to 0.00025″, tool setting gages, and magnetic chucks. Get Bulletin M81 from Brown & Sharpe Mfg. Co., Industrial Products Div'n, Providence 1, R.I., or Circle No. D4.

Wide Range, High Accuracy, and direct reading in vibration and distance are features of the vibration meter described in a bulletin. Model B-731A is best for vibration measurement where direct physical contact is impossible and for measuring dilation and eccentricity of rotating parts. Get Bulletin WK-B-731A from Wayne Kerr Corp., P.O. Box 801, Philadelphia 5, or Circle Inform-A-Gram No. D5.

A New Comparator Adapts Dial Indicators for a wide variety of precision measuring jobs. Model A has a light, yet rigid, aluminum base, and its vertical capacity above anvil is 3⅝″. Other models have 5⅝″ and 7⅝″ capacities. Get details from Petz-Emery, Inc., Pleasant Valley, N. Y., or Circle Inform-A-Gram No. D6.

A Coordinate Comparator, for inspecting and measuring tools, dies, mechanical parts and other opaque objects, is discussed in a bulletin. Precision measurements can be made in either rectangular or polar coordinates. Included are dimensions, features, and a list of accessories. Write Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, for Bulletin 181-58, or Circle Inform-A-Gram No. D7.

COLD HEADING MACHINERY

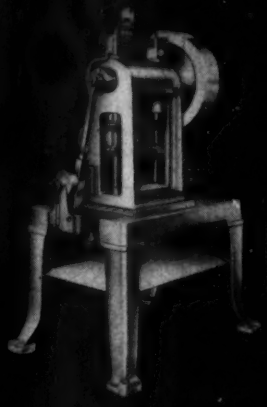


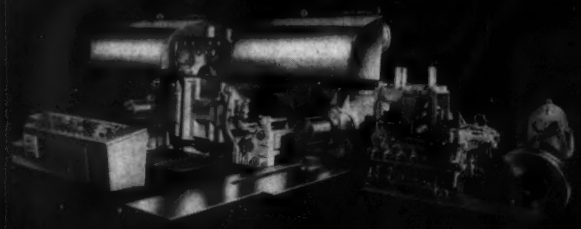
EYELET, SLITTER & WIRE MACHINERY

WATERBURY FARREL

MACHINERY BUILDERS

ROLLING MILL MACHINERY





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THE WATERBURY FARREL FOUNDRY & MACHINE CO.

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Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

WF 56

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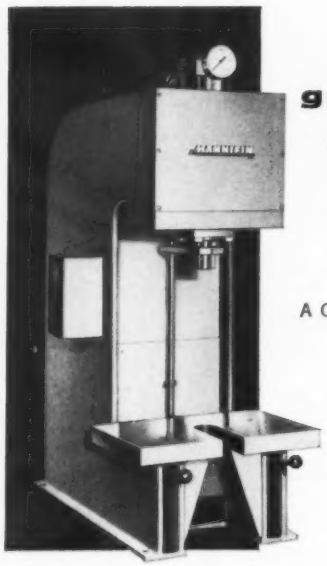

get more production at lower cost with

HANNIFIN

"FD" PRESSES

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A COMPLETELY NEW LINE OF HIGH-SPEED HYDRAULIC BENCH PRESSES

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FAST DELIVERY—ALL THESE SIZES!
2, 3, 4, 5, 6, 8, 10 and 12 TONS

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HEAVY-DUTY OPEN-GAP PRODUCTION PRESSES

Our quantity production gives you highest quality at lowest cost.

THEY HAVE "EVERYTHING"...

Dual Safety Hand Lever Controls
Dual Electric Push-Button Controls
Adjustable Stroke Control
Reverse on Pressure or Distance
Full Automatic Cycling
Hannifin High Speed Hydraulic Index Tables
Reciprocating Hydraulic Slide Feeds

USE THEM FOR...

Assembly Operations
Riveting – Staking
Forming – Stamping
Trimming Die Castings
Trimming Plastics
Molding Semi-Conductors
Preforming – Compacting

MAY BE FLOOR MOUNTED—OPTIONAL, LOW-COST BASES AVAILABLE

Call in your nearby Hannifin man—he's a trained production analyst—to prove how you can do more at lower cost with Hannifin presses. Or, write for our new Bulletin 132A. It tells the whole story.

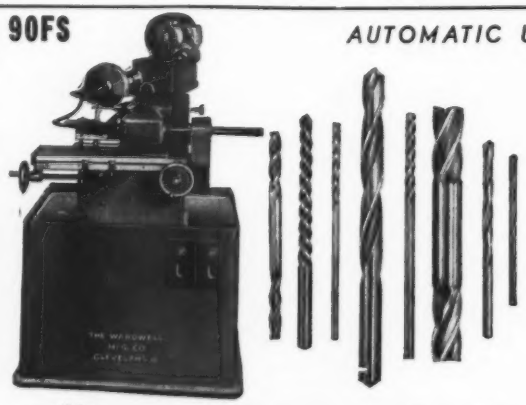
HANNIFIN COMPANY

563 South Wolf Road • Des Plaines, Illinois

A DIVISION OF PARKER-HANNIFIN CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 941

90FS *AUTOMATIC UNIVERSAL*



FLUTE GRINDER

Grinds straight or spiral flutes from solid, including carbides, in tools such as:

Drills as small as 1/16 inch dia. . . .

Spiral or straight taper reamers . . .

Spiral or straight milling cutters and end mills . . . Sharpens saws up to 12 inch in diameter and in gangs up to 7¾" long.

AUTOMATIC INDEX FEED

Write for free Bulletin 90-FS

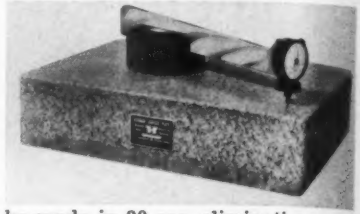
WARDWELL
Manufacturing Co.
3809 Ridge Road
Cleveland 9, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 942

Inspection

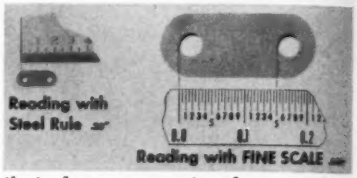
PRODUCTS & PROCESSES & PRODUCTS

Check Tolerance Accuracy of any type or make of surface plate with the Tol-Check instrument. It visually indicates over-all tolerance deviations and accurate evaluations can



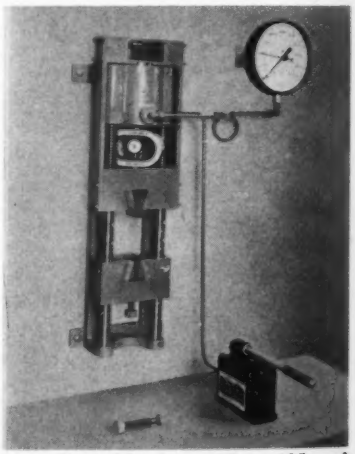
be made in 30 sec, eliminating need for graphs. The Herman Stone Co., 1860 N. Gettysburg Ave., Dayton 27, Ohio, or Circle No. D9.

Gage Small Parts without additional light with the new optical magnifying comparator. Its magnifier compares the part with a transparent, dimensional-scale pattern



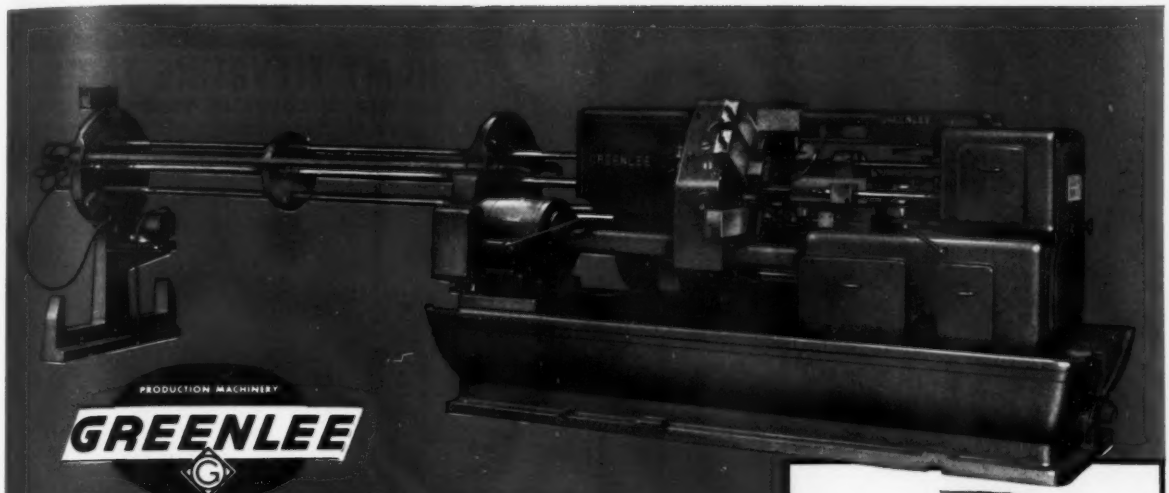
that shows accurate plus or minus measurement. A bulletin is available from Finescale Co., Dept. B-80, 218 S. Western Ave., Los Angeles 4, or Circle Inform-A-Gram No. D10.

This Wall-Mounted Tensile Tester conserves bench space and makes tests on flat or round workpieces, is accurate enough for laboratory use and simple enough for production use. Hardened and ground jaws



are adjustable from 5" to 13", and models are available with up to 40,000-lb capacities. Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, or Circle No. D11.

THE INFORM-A-GRAM CARD FOLLOWS PAGE 98 IN THIS ISSUE.



MULTIPLE FEED-OUTS...

A Natural

on Greenlee Air-Feed Automatics

Feed Out Stock to 16½"
Eliminate Pushers and Feed-Out Cams

Removable fittings attach air lines to the stock reel tubes. A vacuum pump withdraws the piston when restocking. Push-button control panel is provided for starting and stopping.

Greenlee Air-Feed Automatics offer you a 3-way profit advantage:

1. Maintenance and change-over time is reduced by eliminating stock pushers, feed tubes and feed-out cams.
2. Stock can be automatically air-fed to position in one or more machining stations permitting two or more pieces per cycle.
3. Multiple feed-out flexibility enables you to finish machine a variety of pieces that ordinarily demand costly second operation setups.

If you are running into production headaches on a specific job, Greenlee may be able to adapt an "Air-Feed" to solve your problem. See your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

• • •

Greenlee Standard and Special Machine Tools

Multiple-Spindle Drilling and Tapping Machines

Transfer-Type Processing Machines

Six and Four-Spindle Automatic Bar Machines

Hydro-Borer Precision Boring Machines

Die Casting Machines

GREENLEE BROS. & CO.

1741 MASON AVE. ROCKFORD, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 95

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HIGH FREQUENCY *Induction* HEATING

HARDENING
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LEPEL Electronic Tube
GENERATORS—1 KW; 2½ KW, 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
LEPEL Spark Gap Converters
2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

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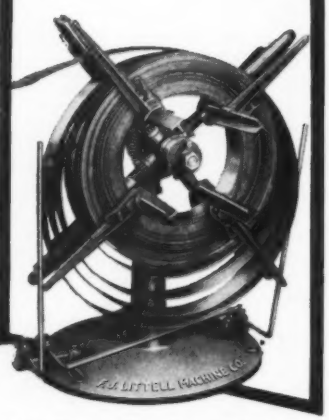
Single and Double Reels In the Small and Medium Range, for coils of 100 lbs. to 10,000 lbs.

Today's order ships tomorrow!



All the famed Littell ease of loading, automatic centering, and smooth, accurate unwinding . . . plus new, fast delivery! Plain and motor driven. Write for full information.

F. J. LITTELL MACHINE CO.
Speed with safety
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Branches: Detroit Cleveland

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THE MOST USEFUL TOOL IN YOUR SHOP!

ECONOMY ELEVATING TABLE

- DIE HANDLER
- CONSTANT HEIGHT TABLE
- LOAD LEVELER
- PORTABLE WORK TABLE

Dimensions.....24" x 36" Lift.....24" min. to 42" max.
Capacity .....2000 lbs. Price: F.O.B. Chicago $245.00

Free 10 day trial in your plant with return privilege

Positive Performance
Self-locking Acme screws hold load safely, securely, at any height. Roller bearing wheels.

Compact Design
No projecting parts—all four sides accessible; crank studs at both ends; three table surfaces.

ECONOMY ENGINEERING
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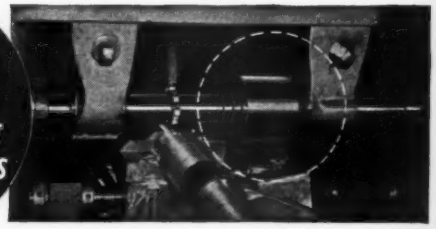
ELIMINATE MILLING MACHINE MAINTENANCE

OF ARBOR OUTER SUPPORT BUSHINGS



OFTEN UPS SPEEDS AND FEEDS 200%

Sound too good to be true? Then see how General Electric, Jeffrey Mfg., hundreds of others absolutely end arbor bushing maintenance problems and decrease production costs on horizontal milling machines by replacing the bronze outer support bushing with a Jergens "Live" Sealed Roller Bearing Unit as illustrated above. Jergens Units with adjustable roller bearings hold precision—permit increases in milling speeds and feeds to take full advantage of carbide cutters. The rigidity of these units increase cutter life and eliminate chatter, frozen bushings, and twisted arbors.

SEE HOW HUNDREDS SAVE THOUSANDS!

WRITE FOR *FREE* CASE HISTORIES OF ACTUAL company performance reports of jobs and dollars saved!

Donley Products, Inc.
Dept. TP-3, 11106 Avon Ave. • Cleveland 5, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 964

Eliminate Need for Transfer Instruments with the new 6″ direct reading cylindrical square, Model 588, that shows variations in units of 0.0002″. Read out-of-squareness by turning and following dotted curve

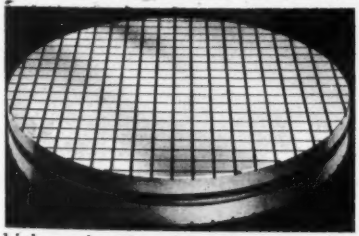
nearest the top edge of workpiece to the top of cylinder. Get Bulletin M-71 from Brown & Sharpe Mfg. Co., Industrial Products Div'n, Providence 1, R.I., or Circle Inform-A-Gram No. D12.

Accurate Reading of all vernier scales is now possible with this new vernier magnifier manufactured by Bausch & Lomb Optical Co., Rochester 2, N.Y. Plastic body lets in avail-

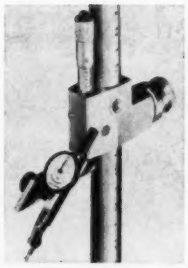
able light and two permanent alnico magnets embedded in base permit attachment to metal scales. Write company for details, or Circle Inform-A-Gram No. D13.

A New Gear Checker with integrated optical system for easy, accurate checking of gear leads is described in a bulletin from Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12. Design, construction, and operational features are given. Checker eliminates gage blocks, multiple settings, and micrometers from the procedure. Write the company for Bulletin 1218-A, or Circle Inform-A-Gram No. D14.

This Lapping Plate is precision ground on both sides for double life. The 8″ x 1″ thick plate has a half round grooved edge for easier handling and lifting, and is made from



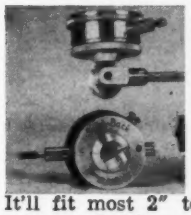
high grade alloyed lapping material, stress relieved to prevent warping. Products Engineering and Mfg. Co., Dwight St., Holyoke, Mass., or Circle Inform-A-Gram No. D15.



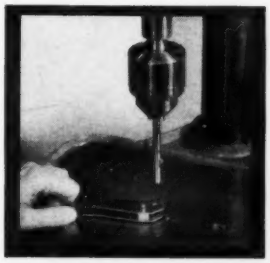
Microball Height Gages afford 50% savings in time and elimination of errors in reading. Use of a new dial indicator comparator gage in conjunction with built-in micrometer makes this possible. Available in 12″ to 24″ heights. Foster Supplies Co., 6122 Milwaukee Ave., Chicago 46, or Circle Inform-A-Gram No. D16.

Inspection

PRODUCTS & PROCESSES & PRODUCTS



An All Angle Positioner allows dial indicator to be positioned in unusual measuring positions for production, toolroom, and die shop inspection. It'll fit most 2″ to 2¼″ dial indicators and light and heavy machines, for visual control for greater and faster precision. Get details from Hubbard-Spring Machine Co., 117 E. 3rd St., Uhrichsville, Ohio, or Circle Inform-A-Gram No. D17.



DEBURRING COSTS CUT 2/3 ON THIS PART!

Spring-loaded Burraway blade chamfers top edges on down-stroke, depresses to pass through stock.

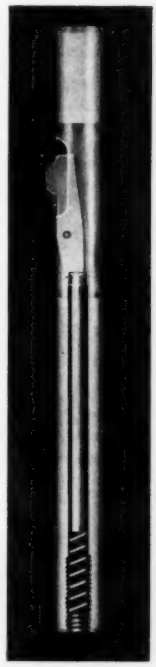
On up-stroke, Burraway blade chamfers under edges. Four edges in just one pass!

One pass of the Cogsdill Burraway tool chamfers four hole edges on this stamped handle. The job previously required four separate passes—two with a right-angle chamfer, two with a standard tool.

Burraway's spring-loaded blade adjusts for light deburring or up to ⅛″ chamfer. On down-stroke, just enough pressure exerts to catch the edge; the blade then depresses to pass through the stock. On up-stroke, the under-edge is similarly chamfered.

Burraway works in any head, on automatics or multiple-spindle machines to eliminate many hand or secondary operations. Its costs are often returned the first day. If you debur or chamfer, you need Burraway.

FOR THE ASKING—Complete Cogsdill catalog on Burraway, Baksink, Bearingizing and other time-saving tooling.



Cogsdill

TOOL PRODUCTS, INC.

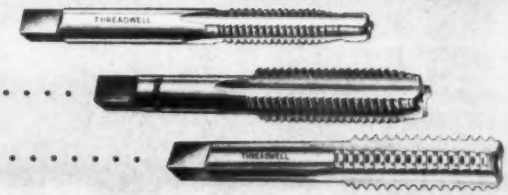
12978 W. EIGHT MILE RD., OAK PARK 37, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 97

***First* with piloted taps . . . . . .**

***First* with TCI taps (for cast iron) . . . . . .**

***First* with interrupted thread taps as standard . . . . . .**



NOW *Threadwell introduces the revolutionary new* TURBO-CUT TAP

- **Maximum chip removal**
- **Utmost accuracy**
- **Reduced tap breakage**
- **Ideal for ductile materials**
- **Fine for blind holes**
- **Excellent in deep holes**

Look at the proven performance:

FIELD TEST #1
Midwest Manufacturer of Tapping Units
Part: Aluminum grommet drilled to a depth of ½"
Operation: Tapping ⅜" deep
Production: 70 pieces/minute
Result: 18,000 holes tapped with one #10-24 "Turbo-Cut" Tap and *still usable.*

FIELD TEST #2
New England Manufacturer of Plumbing Fixtures
Part: Polystyrene bathroom accessory
Operation: Tapping
Production: 50,000 holes tapped with one ¼-20 "Turbo-Cut" Tap and *still usable.*
This is not a misprint.

See your Threadwell Distributor for complete details or write direct to:

Threadwell

INDUSTRIAL DISTRIBUTORS SERVING INDUSTRY ECONOMICALLY THE RIGHT HAND OF PRODUCTION

THREADWELL TAP & DIE COMPANY Greenfield, Mass., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 98

READER SERVICE CARD

INFORM-A-GRAM

MARCH 1959 ISSUE

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Please have information on items circled sent to me.

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14	34	74	98	962	1071	1113	1172	1261	
15	35	75	99	963	1072	1114	1173	1262	
16	36	77	100	964	1073	1115	1181	1263	
17	37	78	121	1011	1081	1121	1191	1264	
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EDITORIAL ITEMS

A1	A19	D2	E3	F13	G1	J2	K13
A2	A20	D3	E4	F14	G2	J3	K14
A3	A21	D4	E5	F15	G3	J4	K15
A4	B1	D5	E6	F16	G4	J5	V1
A5	B2	D6	E7	F17	G5	J6	
A6	B3	D7	E8	F18	G6	J7	
A7	B4	D8	F1	F19	G7	K1	
A8	B5	D9	F2	F20	G8	K2	
A9	B6	D10	F3	F21	H1	K3	
A10	B7	D11	F4	F22	H2	K4	
A11	B8	D12	F5	F23	H3	K5	
A12	B9	D13	F6	F24	H4	K6	
A13	B10	D14	F7	F25	H5	K7	
A14	C1	D15	F8	F26	H6	K8	
A15	C2	D16	F9	F27	H7	K9	
A16	C3	D17	F10	F28	H8	K10	
A17	C4	E1	F11	F29	H9	K11	
A18	D1	E2	F12	F30	J1	K12	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of TOOLING & PRODUCTION readers who, we know, rarely have stenographic help at their back-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

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8	26	67	87	901	1043	1101	1143	1232	1306
9	27	68	89	902	1044	1102	1151	1233	
10	28	69	91	921	1051	1103	1152	1234	
11	29	70	93	941	1052	1104	1153	1235	
12	30	71	95	942	1061	1111	1161	1251	
13	33	72	97	961	1062	1112	1171	1252	
14	34	74	98	962	1071	1113	1172	1261	
15	35	75	99	963	1072	1114	1173	1262	
16	36	77	100	964	1073	1115	1181	1263	
17	37	78	121	1011	1081	1121	1191	1264	
18	38	79	124	1012	1082	1122	1192	1291	
19	39	80	127	1013	1083	1123	1193	1292	

EDITORIAL ITEMS

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A3	A21	D4	E5	F15	G3	J4	K15
A4	B1	D5	E6	F16	G4	J5	V1
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A7	B4	D8	F1	F19	G7	K1	
A8	B5	D9	F2	F20	G8	K2	
A9	B6	D10	F3	F21	H1	K3	
A10	B7	D11	F4	F22	H2	K4	
A11	B8	D12	F5	F23	H3	K5	
A12	B9	D13	F6	F24	H4	K6	
A13	B10	D14	F7	F25	H5	K7	
A14	C1	D15	F8	F26	H6	K8	
A15	C2	D16	F9	F27	H7	K9	
A16	C3	D17	F10	F28	H8	K10	
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Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Building, Pittsburgh 22, Pa. Address Dept. TP-15

WSW 7265 A

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

CIRCLE INFORM-A-GRAM KEY NO. 99

Materials

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES

"Thrift" Low Carbon Precision Ground Flat Stock has been announced by Brown & Sharpe Mfg. Co., Providence 1, R.I. Precision ground to a 35 micro-inch finish, it has easy machining characteristics for fast production. The 24" long stock range from 1/16" to 2 7/8" thick and up to 16" wide. Get Bulletin M80 from the company or Circle Inform-A-Gram No. E1.

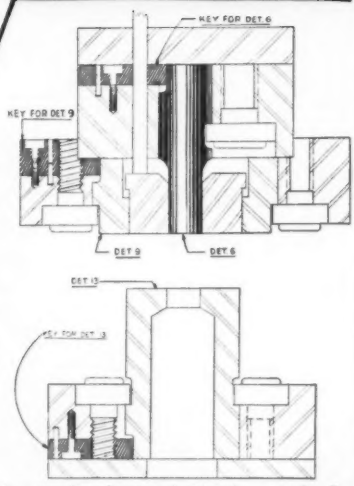
This Cobalt Tool Steel comes in large flat bar sizes of 3" x 7", 4½" x 6", and 4" x 10". PRK-33 is ideal for heavy-gauge stamping and severe applications for long runs for broaches, gages, and knurling and burnishing tools. Available in rounds to 10", flats to 4" x 10", and squares to 5". Darwin & Milner Inc., 2345 St. Clair Ave., Cleveland 14, or Circle Inform-A-Gram No. E2.

NEW
HOVIS KEY-ALIGNED DIE
THE LATEST ADDITION TO OUR STANDARD UNITS

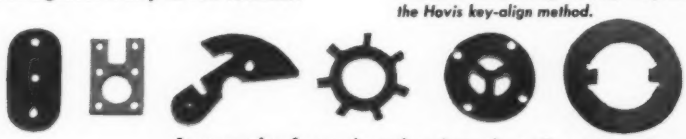
a must for irregular stampings

ELIMINATES ALL SET-UP ERRORS AND INSURES UNINTERRUPTED ACCURACY

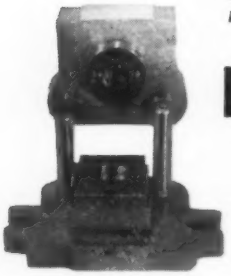
When producing irregular shaped stampings, it is important that the cutting members of the die are located in the proper radial alignment. Hovis has introduced the key-aligned die to meet this requirement . . . With the key-aligned die any press operator can install the inserts without the possibility of misalignment. This is accomplished with a flat on the insert which locates against a key in the retainer.



A section line drawing showing the principle of the Hovis key-align method.



An example of some irregular pieces these dies produce by merely purchasing special sets of parts on which we are glad to quote



Made in 6 sizes:
¾"-1½"-2½"-4"-6"-8"

HOVIS UNIVERSAL COMPOUND DIES

for producing WASHERS and SMALL STAMPINGS . . . No need to make a NEW DIE for every STAMPED PART

By simply removing and replacing five, small, interchangeable inserts a new part may be produced . . . This method makes possible all production including irregularly shaped pieces and shallow draws.

HOVIS SCREWLOCK COMPANY
8100 E. NINE MILE ROAD • BOX 97 • WARREN, MICHIGAN
Phone: Slocum 7-4800 Suburb of Detroit

CIRCLE INFORM-A-GRAM KEY NO. 100

TUBING STOCK

Joseph T. Ryerson & Son, Inc. announces a new leaded steel tubing material available from warehouse stocks. Ledloy 170 is a cold drawn seamless steel tubing of low carbon analysis with 0.15 to 0.35% lead added.

Use This Air-Hardening Weldable Alloy for highly stressed parts at temperatures up to 1050°F where joining is a problem. Carpenter 424 alloy is highly corrosive resistant, has high tensile strength, good ductility, and is available in various forms. The Carpenter Steel Co., Reading, Pa., supplies data sheet or Circle Inform-A-Gram No. E3.

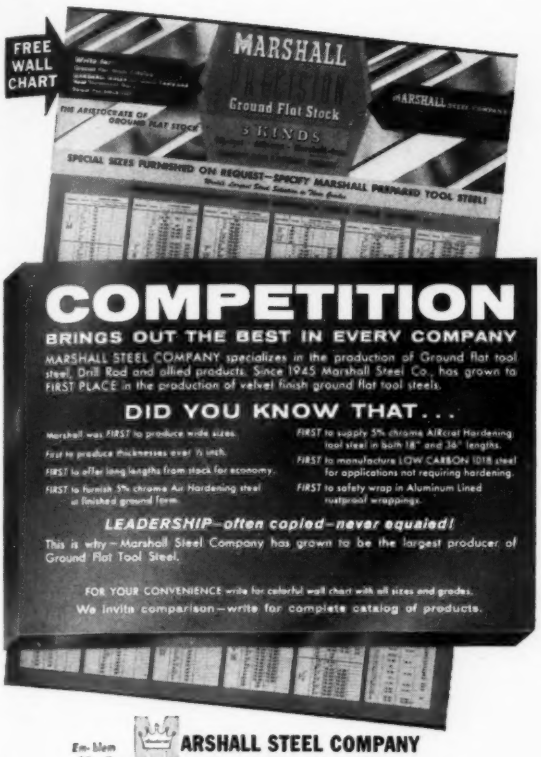
"Aluminum Mill Products" is a 24-page booklet which gives characteristics and typical properties. Those covered include sheet, plate, foil, rod, bar, wire, extrusions, tubing, and forgings. Get your copy from Kaiser Aluminum & Chemical Sales, Inc., Dept. NR-19, 919 N. Michigan Ave., Chicago 11, or Circle Inform-A-Gram No. E4.

Nuclear Steels, with low manganese and cobalt, have formability, weldability and strength characteristics for commercial use. They come in plate, sheet strip, bars, tubing, and rods, and can be welded and fabricated by conventional methods. Write Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 19, for information, or Circle Inform-A-Gram No. E5.

Highly Corrosion Resistant Alloy C is outlined and discussed in a 16-page booklet. Chemical, physical, and mechanical properties are presented in charts and graphs. High-temperature properties are included. Get a copy from Haynes Stellite Co., Div'n of Union Carbide Corp., Kokomo, Ind., or Circle Inform-A-Gram No. E6.

A New Hard Facing Welding Alloy, Rexweld 66, has extremely long life. Designed for hot work applications, it is highly resistant to thermo-shock impact, and compressive loads at high temperatures and won't chip under the most severe service. Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 22, or Circle Inform-A-Gram No. E7.

Wrought Copper and Copper-Base Alloys are listed in a 14-page bulletin that covers properties, forms, and composition. Ratings for corrosion resistance, as well as hot working and annealing range, and fabricating properties, are also included. Western Brass Sales, Metals Div'n, Olin Mathieson Chemical Corp., E. Alton, Ill., supplies copies, or Circle Inform-A-Gram No. E8.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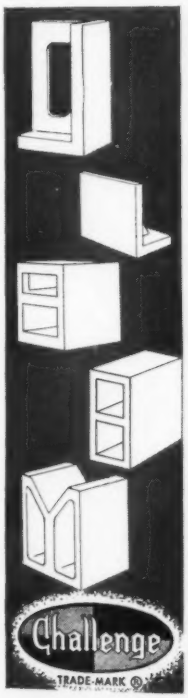

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- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

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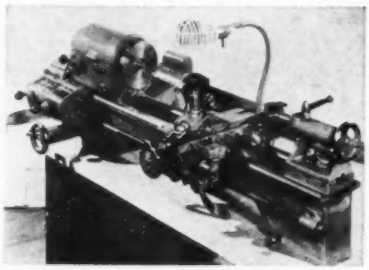
CIRCLE INFORM-A-GRAM KEY NO. 1021

Machining

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

This Delta 10" Metal Cutting Lathe features variable-speed drive and ¾" collet capacity. Infinitely variable speed from 50 to 1500 rpm and high torque transmitting power of matched V-belts in the final drive



of the spindle are possible. Get details from Rockwell Mfg. Co., Delta Power Tool Div'n, 451 N. Lexington Ave., Pittsburgh 8, or Circle Inform-A-Gram No. F1.

WHEELS FOR STEEL

Diatronic diamond cutting wheels are being distributed by The DoAll Co., for the Navan Products, Inc. The wheels are thin with close tolerances and cut high temperature steel and alloys.

Two Rotary External Gear Finishing Machines are detailed in a brochure that gives close-up photos of the underpass, modified underpass, and transverse gear shaving methods possible with this machine. Mechanical and physical specifications are also given. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, or Circle Inform-A-Gram No. F2.

These Solid Carbide Drills feature limited deflection design for accurate on-size drilling of non-ferrous, nonmetallic, and some alloy steels. Good

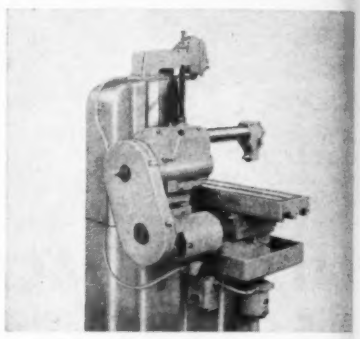
for long run drilling of abrasive materials. Get Bulletin 805 from M. A. Ford Mfg. Co., Inc., Davenport, Iowa, or Circle No. F3.

A New Chemical Solution performs heavy-duty, low-clearance low-speed operations previously done by cutting oils. Cimcool Cimperial, a simple mix fluid, covers 95% of all metal cutting jobs. The extreme pressure additives in Cimperial reduce heat of metal cutting and permit faster feeds and speeds, producing better finish and more efficient metal cutting action with less force on the tool. This chemical fluid won't turn rancid and has exceptional rust control qualities. Catalog PC-359 is available from The

For Toolroom and Production Use, use the standard and special HSS cutting tools featured in a catalog. Specifications and illustrations are included for HSS Woodruff cutters, dovetail cutters, combined drill and countersinks, and milling cutters. Get Catalog 58 from Quality Tool Works, 760 S. Market St., Waukegan, Ill., or Circle No. F4.

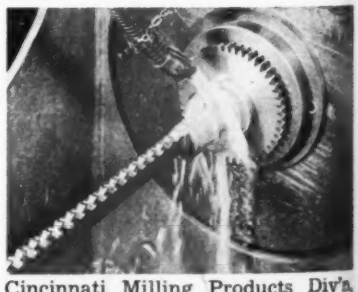
A Vertical Milling Head Attachment with infinite feed to 100 to 3600 rpm and dial control infinite feed from 0.0 to 0.012 is described in a bulletin which gives operating features and dimensions. Write to Rusnok Tool Works, 4840 W. North Ave., Chicago 39, or Circle No. F5.

Ruggedly Built Bed-Type Milling Machines are for rapid milling of light and medium production work. Models for small lot production work, for longer production runs,



and low production and toolroom work. For information, write The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn., or Circle Inform-A-Gram No. F6.

Adapt New Universal Spiral-Drive Telescopic-Type Dividing Head for any milling machine with the featured three-way adjustment. It can be used as a plain dividing head and comes to 10" to 12" models, right or left hand, with or without direct indexing. Greaves Machine Tool Co., Div'n of J. A. Fay & Egan Co., 2011 Eastern Ave., Cincinnati 2, or Circle Inform-A-Gram No. F7.



Cincinnati Milling Products Div'n, Cincinnati, Ohio, or Circle Inform-A-Gram No. F8.

Any speed from 50 to 11,000 fpm with this Vastly Superior NEW BAND SAW by TANNEWITZ

Ideal for tool room sawing, trimming castings or friction sawing steel and other metals formed or flat . . . the most versatile, efficient and best built machine in the field. Note these new features:

1. **HEAVIER CONSTRUCTION** than any machine of its type — solid as a rock.
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3. **EASIER BLADE TENSIONING** by remote control hand wheel on column.
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These and dozens of other features that make it the greatest time and money saving metal cutting machine on the market. Write or phone for complete details.

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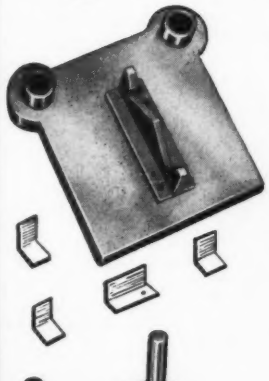
CIRCLE INFORM-A-GRAM KEY NO. 1031

Punches and Dies

Angle Iron Cut Off Die



No. 18, cut off die, for 2" x 2" x ¼" and lighter angles. Mounted in leader pin die set. Fits most all makes of 25-ton and larger presses. Simple shearing action insures straight, clean cut WITHOUT DISTORTION. Another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Also adaptors and die shoes to convert your press. Each precision-made.

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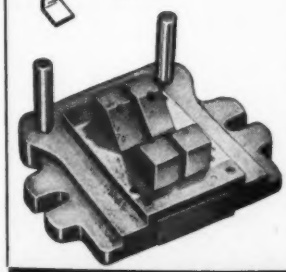

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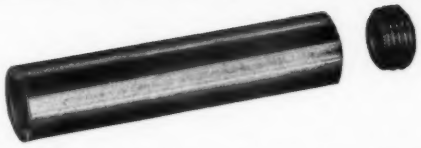

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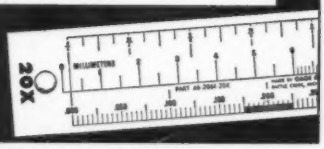

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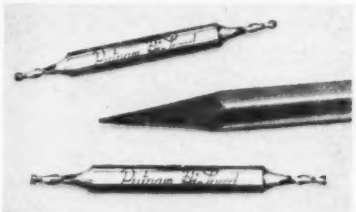
Small Single or Double End Mills, as little as 1/32" dia, are for milling, profiling, routing, or engraving in small hard-to-get at areas without



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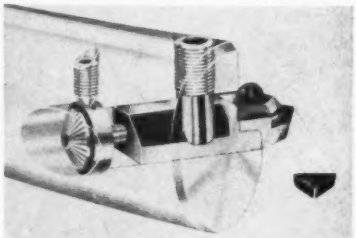
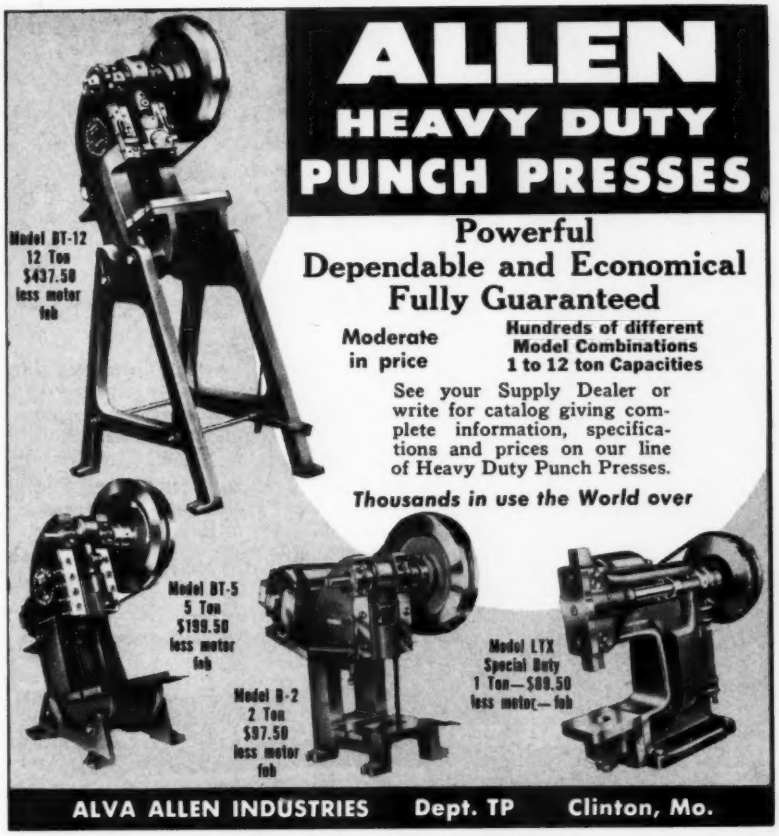


rigid locking method, compact design, and low profile for plenty of chip room. Valenite Metals, Box 205, Royal Oak, Mich., or Circle Inform-A-Gram No. F12.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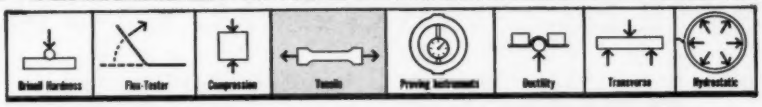

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Write or call Steel City if you have any testing problems.

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Machining

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This Fully-Adjustable Micrometer-Stop Countersink is fast cutting and lightweight and may be used for volume production work and drill presses, lathes and mills. It features hardened and cylindrically

ground steel alloy shaft operating within an extra-large self-lubricating bearing. Accuracy is ±0.001". Get Catalog NR218 from Schrillo Aero Tool Engineering Co., 8715 Melrose Ave., Los Angeles 46, or Circle Inform-A-Gram No. F14.

This Heavy-Duty Spacemite Drill Motor gets into hard-to-reach places to increase productivity and improve quality. Rugged construction permits overload conditions up to ½"

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Cuts cost of feeding parts to drill, tap, mill, punch, assemble

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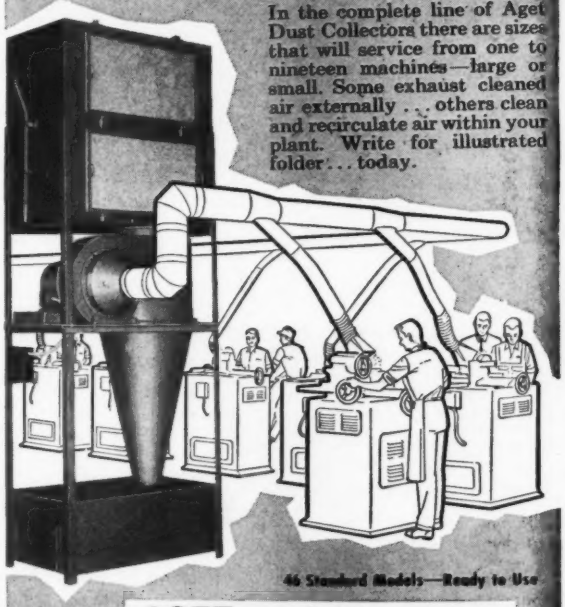

46 Standard Models—Ready to Use

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in just 48 seconds

THIS HAND clamps 96 cylinders from one source

It's a fact! This hand, with one pump activates 96 clamps simultaneously. The Newton Hydraulic Clamping System of pumps, cylinders and mounting parts provides ease of application . . . Cuts production time . . . And is moderate in cost.

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AUBURN, MASSACHUSETTS, U.S.A.

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PRESS ROOM EQUIPMENT

ROLL FEEDS
Accurate Feeding — Reversible
Easy to install
Highest Quality
Increased Production at Low Cost

SCRAP CHOPPER
Fits any Power Press
Electrical Plug Installation.
Pays for itself you get more for your scrap.

STOCK ORER
Saves your dies eliminates hand oiling
Made in variety of sizes

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for new catalog showing prices and complete line of Equipment.

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LOW COST 5" Magnetic Sine Bar

ONLY $149.95

MODEL #1805M

5" x 3"

WORKING SURFACE ON PERMANENT MAGNETIC CHUCK

Positive locking provides rigid set-up for light machining operations. End and side plates allow accurate locating of pieces on magnetic chuck making it a versatile, low cost fixture. Ideal for production, inspection or tool room.
OTHER MODELS include 5" and 10" sine bars and plates, single and compound angles, plain and magnetic. Solid oak cases available.

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TORQUE MANUAL

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ADDISON QUALITY ILLINOIS
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Straight Type Offset Type

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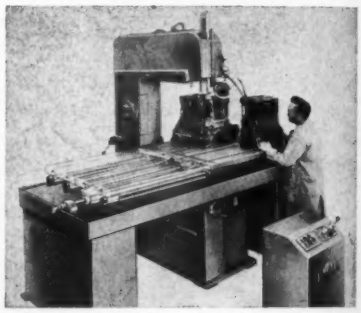
Machining

PRODUCTS & PROCESSES & PRODUCTS

Carbide Reverse Countersinks and spotfacers are now available for use on the harder, more difficult to machine materials. The Series 180-C countersinks and 190-C spotfacers range from ¼" to 1¼" with sizes ¼" through ½" made of solid carbide. Craig Tools, Inc., 133 Lomita Ct., El Segundo, Calif., or Circle Inform-A-Gram No. F16.

This Double-Eccentric Adjustable Drill Head is used with three to eight spindles for drilling, tapping, boring, and reaming. It features full ball bearing construction and can be operated vertically, horizontally, or inverted. Catalog 1B from Thriftmaster Products Corp., 1048 N. Plum St., Lancaster, Pa., gives dimensions, or Circle Inform-A-Gram No. F17.

Extended-Travel Work Table Band Machines are now available for jobs that don't need a large capacity machine but need large work



tables with long feed strokes. HB machines have 41" working stroke and 40" x 44" work table. Write The DoAll Co., Des Plaines, Ill., for information, or Circle No. F18.

Simpler and Faster Small Hole Drilling is possible with the new precision tool introduced by Hunter Tool, Santa Fe Springs, Calif. Used on milling machines, jig borers, lathes, and drill presses. Just lock drill into position and control drilling pressure with finger tips. Get a catalog from company, or Circle Inform-A-Gram No. F19.

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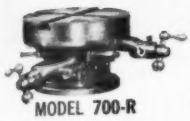
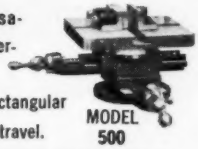
ORIGINALLY F & M SALES COMPANY

...engineered for precision



MODEL 700-R
For heavier work, Model 700-R has 7½" diam. table, 4½" x 4½" travel, ground work surface.

Since 1937 a versatile tool for numerous jobs on the drill press. 7" rectangular table, 4½"x4½" travel.



MODEL 500

SOLD THROUGH YOUR LOCAL DEALER

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SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

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dead true at the center!

—in draw-in COLLETS

Made in standard and special styles for all lathes, grinders, millers, and fixtures. Fractional round sizes and decimal equivalents from 1/64" to capacity; square, hexagon and taper holes. Checked 25 times against master gauges. Transparent packaging for easy identification.

Stocked in standard styles for immediate delivery.

Get free Bulletin 100 E showing standard draw-in collets and step chucks

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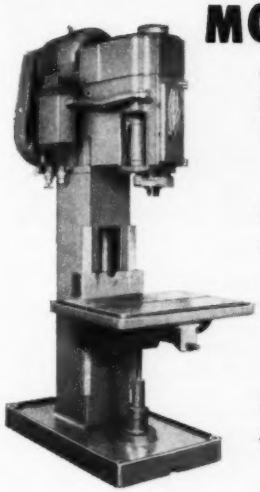
FOR HIGH SPEED PRECISION TAPPING *CHOOSE THE*

KAUFMAN

MODEL 10E-20



Check these six features of this new, precision-built Kaufman Tapping Machine:

1. Lead screw control for accurate threads and maximum tool life. Maximum 4½" lead screw travel.
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3. Clutch operated for faster operation — Reversing spindles at twice forward speed.
4. Six speed transmission providing spindle speeds of 80-350 RPM with 3-1 ratio or 160-700 with 1½-1 ratio clutch.
5. Units provided with 5-7½-10 H.P. motors.
6. Speeds and H.P. available for highly efficient tapping from 5/16" through 2" NC taps or smaller taps with use of multiple head.

For additional information about the new Model 10E-20 or other Kaufman machines for single or multiple operation, write or telephone:

KAUFMAN MFG. CO.

529 S. 29th Street. Manitowoc, Wisconsin

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DRILLHEADS

Universal Joint Type Drillhead . . . Full Ball or Bronze Bearing Construction, Standard or Heavy Duty. From ½" minimum centers up. Capacities to ½" in Steel.

Gear Driven Eccentric Type Adjustable Drillhead . . . Enclosed, Full Ball Bearing Construction. Double Eccentric Type Adjustable Drillhead illustrated.

- **We stock or can build the right drillhead for your jobs.**
- **Write for your free copy of the THRIFTMASTER CATALOG or phone for a rush, on-the-spot, quote.**

Makers of DORMAN AUTOMATIC REVERSE TAPPERS

Special Fixed Center Drillhead . . . Made to your requirements. Full Ball Bearing Construction.

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CIRCLE INFORM-A-GRAM KEY NO. 1095

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Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises, and adjustable angle plates are illustrated and fully described in the New Palmgren Catalog. This is the only complete line of work holding devices available anywhere. Designed for production, tooling, and maintenance work, there are 68 different models and types to choose from. Vise jaw sizes are from 1½" to 8". Ask for your copy of this FREE Catalog No. 205 today. The complete line with details and prices are shown.

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Cuts the FASTEST and FINEST NOTCHES Ever Made!

ARC-SNUG

ARC-SNUG gives you clean-edge, close-fitting, true contour notching by making both the first and second cuts of the notch in a single downstroke of the press. Notches ½" to 1¼" O.D. metal tubing (16 gauge and under) at angles ranging from 35 to 90 degrees. Special sizes and special dies to cut stainless steel, Monel metal, etc., made to order. Dies for various angles and sizes are interchangeable. Write for literature.

NOTCHED SAMPLES GLADLY FURNISHED

Combines 2 operations in one...

to give you the snuggest fitting, angular tubing joints for cheaper, quicker, easier induction welding or brazing.

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DIE CUSHIONS

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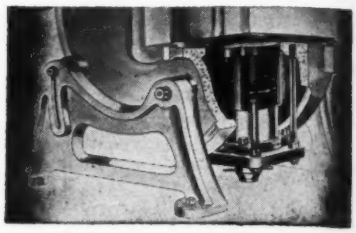
FOR ALL PUNCH PRESSES

to assure accurate working pressure on all dies

- Single or multiple installations standard or designed on the job.
- Best possible delivery.
- Quotations on request.



Full Universal Pneumatic Die Cushion

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DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1103

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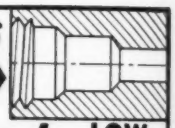

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High Speed Steel STEP DRILLS

DO THE TRICK!

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PROMPT SERVICE – Write for Complete Data

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BORING TOOLS

WORK LIKE MAGIC!

(H. S. S. and Carbide)
for Holes from 1/16" upward

STANDARD AND SPECIAL BORING, FACING & INTERNAL THREADING TOOLS. Write for Data

Bore Small Holes? Contact COMET

COMET Tool Co.

738-TP-3 Broadway • New York 3, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1104

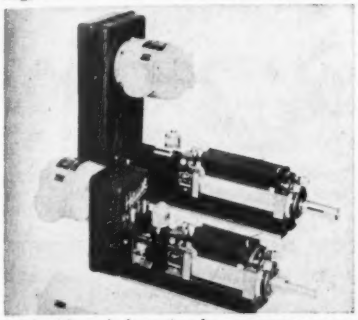
Machining

PRODUCTS & PROCESSES & PRODUCTS

Burnishing Teeth on Round Broaches now produce glassy finish to precision tolerances. Used in an arbor or hydraulic press, these push-

type Minute Man broaches finish to exact size in one pass. Available in 13 sizes (for ¼" to 1" round holes). The duMont Corp., Greenfield, Mass., or Circle Inform-A-Gram No. F20.

New Holomatic Drill Units with 6" to 10" stoke capacities are for production drilling, reaming, centering, and facing. Drilling capabilities



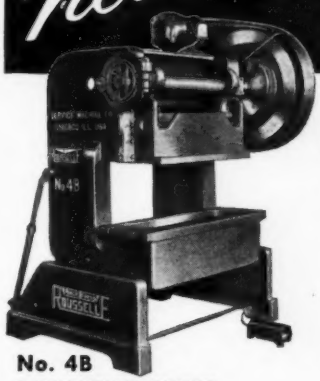
with 80 psi input air pressure are 1/32" to 5/8" dia holes in mild steel Hause Machines, Inc., 809 S. Pleasant, Montpelier, Ohio, or Circle Inform-A-Gram No. F21.

A Cylindrical Die Thread Rolling Machine, introduced in a bulletin, is suitable for large or small production. Typical methods of feeding are illustrated as are special features, applications, and operation hints. For Bulletin B-111-1, contact Reed Rolled Thread Die Co., 791 Main St., Holden Mass., or Circle Inform-A-Gram No. F22.

Reduce Toolholder Inventories and permit range of inserts to be used in the same toolholder by converting triangular insert toolholders to universal type. Convertible seats

are available to adapt Lift-O-Matic toolholders for inserts 3/8" IC through 5/8". Metallurgical Products Dept., General Electric Co., Detroit 32, or Circle Inform-A-Gram No. F23.

New 40-TON DOUBLE CRANK O.B.I. ROUSSELLE



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WITH NEW ELECTRICALLY CONTROLLED AIR CLUTCH

- "Plug-in" foot and hand controls.
- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
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CHOICE OF 30 SIZES AND TYPES IN 5 TO 40-TON PRESSES

SERVICE MACHINE CO.
Mfrs. of Rousselle Presses
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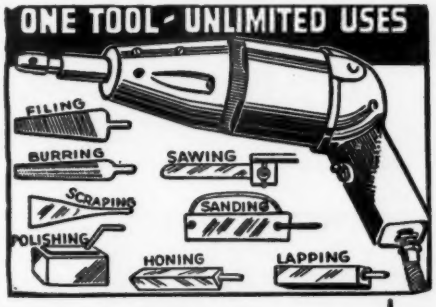
Use these Handy PORTABLE ELECTRIC RECIPROCATING TOOLS for Greater Production, Better, More Uniform Work — All with less Operator Fatigue. Fixed strokes are 1/8" or 3/8" long. Operate on 110 Volts AC-DC. Deliver 1000 PUSH-PULL strokes per minute. Try one of these tools on your next job.

Send for Descriptive Literature



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Stops Losses
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Since 1907

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- Standard Sizes 1¼ to 4 Standard with Straight or Morse Taper Shanks
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566 HOLLENBECK ST. • ROCHESTER 21, N. Y.
Adjustable Hollow Mills • Facing and Counterboring Tools • Special Production Tools • Since 1908

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NEW CARL ZEISS JENA OPTICAL DIVIDING HEAD

PERMITS PRESETTING TO ANY DESIRED MINUTE AND SECOND FACTOR FOR NEXT OPERATION WHILE FIRST OPERATION IS IN PROGRESS

does not depend for accuracy on worm, worm gears or index plates. It is a thoroughly practical, rigidly constructed tool.

AT LAST.. available again the ORIGINAL CARL ZEISS JENA

INDEXING BY A DIVIDED GLASS CIRCLE AND VERNIER, FULLY PROTECTED AND ENCASED, MOUNTED DIRECTLY ON SPINDLE, THUS NO INACCURACY FROM GEARING, WEAR OR PLAY.

BUILT FOR PRODUCTION USE on MILLER and GRINDER

Accuracy ±5 Seconds
Range of Scale: 0 to 360 Degrees

WE GUARANTEE EXPERT SERVICE ON ALL CARL ZEISS-JENA INSTRUMENTS AT ALL TIMES

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...available FROM STOCK in 132 standard types and sizes

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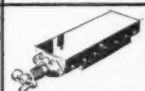
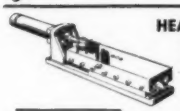
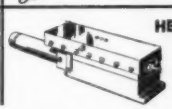
LIGHT DUTY TYPE WITH RETURN SPRING

HEAVY DUTY MICROMETER STOP TYPE

LIGHT DUTY LEAD SCREW TYPE


HEAVY DUTY LEAD SCREW TYPE


HEAVY DUTY CYLINDER POWERED (in-line mount)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Do you think John likes our ACME TAPS?

A LITTLE OVER A YEAR AGO a prominent manufacturing firm in the Cleveland area bought a 3" diameter 2 thread per inch "single Pass" Acme Tap from us. We designed and made the tap and shipped on the date promised after testing in our shop.

In Cleveland about 3 months later, the plant super., John, said he didn't expect much from our tap and had single tooled the thread on five parts before the tap arrived, just to be "safe", but on the day the tap was delivered he tapped out 50 of these cast iron nuts.

John sure does like our Acme Taps and so do lots of other people. Several customers report that they paid for the tap the first time it was on the machine.

These taps are available* from stock, too, in size from $\frac{3}{8}$" to $2\frac{1}{2}$" diameter, many left hand and special pitch taps on hand also.

We have been in the threading business for over 20 years now and have worked out a lot of tough ones. We will be glad to help you too.

Our descriptive literature sent on request.

*The only Acme Tap stock in the country.

H&R
The Threading Specialists

HORSPOOL & ROMINE MANUFACTURING CO., INC.
5850 Marshall Street Oakland 8, California

CIRCLE INFORM-A-GRAM KEY NO. 1131

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Write for your FREE copy today.

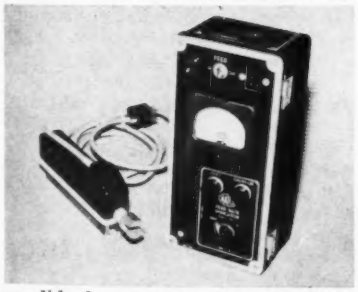
JERGENS TOOL SPECIALTY CO.
Dept. TP-3, 712 E. 163rd St., Cleveland 10, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1132

BROACHING PICTURE

Fundamentals of modern broaching are outlined in a 30-min, 16mm film, "Precision Broaching for Production and Profit." Basic broaching machines through intricate fully-automatic high-production machines are reviewed. Broaching tool and fixture close-ups show the process and application possibilities. The Laponite Machine Tool Co., Hudson, Mass.

Easily Gage forward and reverse feed rates of machine tool components with this feed rate indicator powered by 110 volt a-c. Range is 0 to 50 in/min over 4" of travel. Pickup is mounted on machine way



or slide by permanent magnets in its base, and feed rate is read directly from dial on control components. National Automatic Tool Co., Inc., Richmond, Ind., or Circle Inform-A-Gram No. F24.

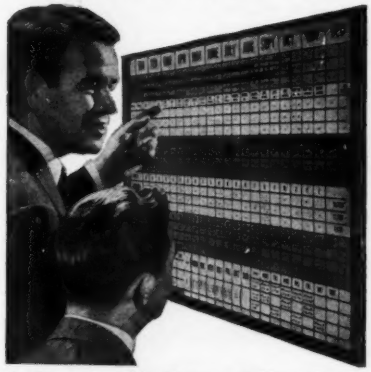
MACHINING HSS

Practices for machining stainless steel to improve quality, production, and job-shop output are related in a film, "Machining Stainless Steels." Write to Armco Steel Corp., 5758 Curtis St., Middletown, Ohio, to get on the schedule.

Cutting Tool Line is described in a 27-page catalog that gives dimensions for solid carbide end mills, die sinking cutters, keyseat cutters,

chucking reamers, and boring tools. Get Catalog 101 from Rico Tool Co., 5915 Dixie Hwy., Saginaw, Mich., or Circle Inform-A-Gram No. F25.

You Get Things Done With Boardmaster Visual Control



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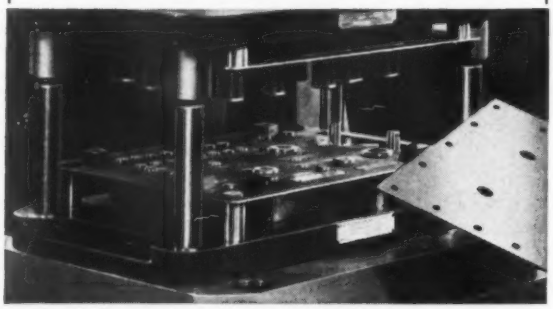
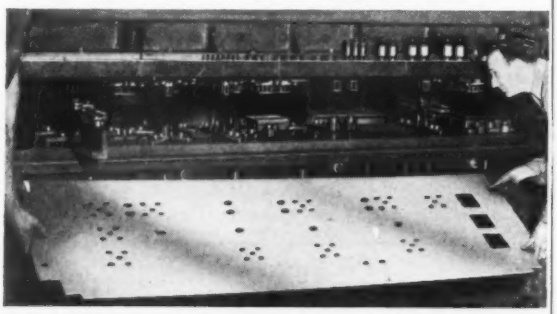


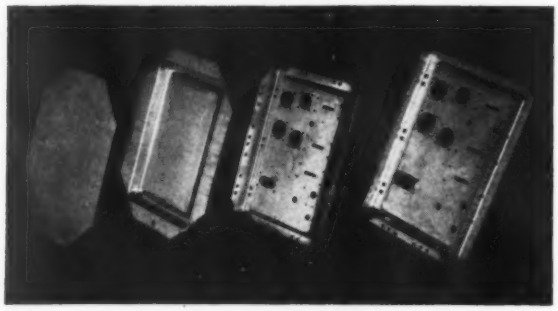
MAGNETIC PERFORATING DIES

All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.



ADJUSTABLE PERFORATING DIES

All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.



manufacturer of all types of
CUSTOM DIES for over 40 years

WRITE FOR COMPLETE DETAILS

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748 Military Rd., Buffalo 23, N. Y.

Mail the following: ☐ Magna-Die Catalog ☐ Adjustable Die Catalog
☐ More information on custom die work

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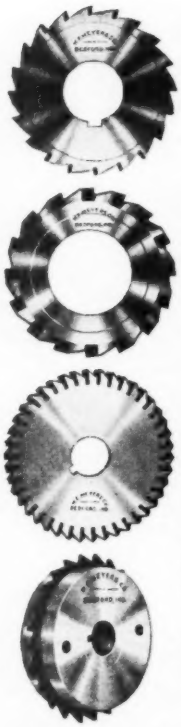
CIRCLE INFORM-A-GRAM KEY NO. 1141



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Carbide Tipped and Solid Carbide
CUTTING TOOLS

It costs no more to enjoy the production advantages of MEYCO tools: "precision" minded since 1888, careful workmanship, well equipped shops and capable design engineers . . . all add up to plus values for you.

The finest quality and proper grade of tungsten carbide is engineered to the cutter's job. Tools are precision ground and lapped for long life, tipped to carefully machined bodies balanced for rigidity. MEYERS works to tolerances of .0001", tipped cutters as thin as .030", solid carbide cutters much thinner, diameters of ¼" and up.

Your special problems in the field of cutting, slitting, slotting, under-cutting or form-cutting are solicited.

Write for new Cutter Catalog No. 51

W. F. MEYERS CO., INC., BEDFORD, IND.

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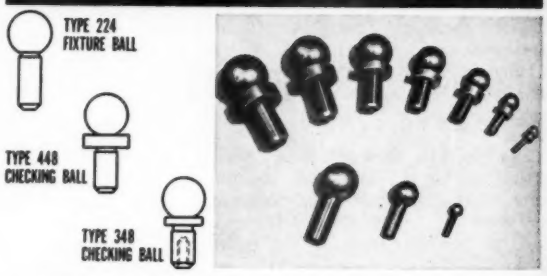
High-Precision Stainless Steel
TOOLING BALLS



- For gage, jig and tool work. Center of ball provides positive reference point for work in any plane.
- Highly accurate. Ball size held to ±.0001" for fixture balls; ±.00002" for checking balls.
- Durable; corrosion-resistant. Made of Type 440-C stainless steel, hardened to 55-58 Rockwell C.
- In stock: Types 224 and 448 in 7 ball sizes, ¼" through 1" by ⅛" steps; Type 348 with ½" ball and 6-32 tapped shank. Other sizes to order.

WRITE FOR price list and ASTE Data Sheet.

INDUSTRIAL TECTONICS, Inc.
3677 Jackson Rd., Ann Arbor, Michigan

PRECISION BALLS OF ANY SIZE OR MATERIAL
ANTI-FRICTION BEARINGS FOR SPECIAL REQUIREMENTS
TOOLING BALLS — MASTER BALLS — SPHERICAL FINISHING

CIRCLE INFORM-A-GRAM KEY NO. 1143

Machining

PROCESSES & PRODUCTS & PROCESSES

Rough and Finish Boring and Reaming Tools are outlined in an 18-page catalog. Dimensions are given for reaming and roughing bars, reaming and roughing cutters, and grinding arbors. Applications are included. Write Muskegon Tool Industries, Inc., 11th St. at Western, Muskegon, Mich., for "Inner Diameter Tools" Catalog, or Circle F26.

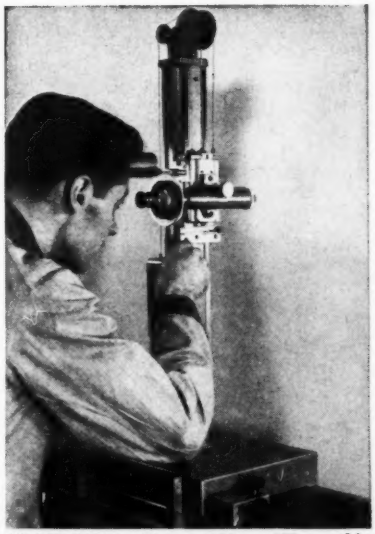
Precision, Gun, or Deep Hole Drilling is possible with the new standard gun drilling machine announced by Crescent Tool & Machine Co., Inc., 25125 W. Outer Dr., Melvindale, Mich. Handles two parts

at the same time, drills holes from 0.187" to 0.750" dia, and feed stroke is from 1" to 12". Get details from the company, or Circle Inform-A-Gram No. F27.

A Heavy-Duty High-Production Precision Boring Machine for both precision and heavier machining operations is featured in a bulletin. Design and operating features for Model 22 are covered. Specification diagrams are included. Get copy from Olofsson Corp., Lyons Ave., Lansing, Mich., or Circle Inform-A-Gram No. F28.

A Duplicator Table permits fast, easy, and exact two dimensional contour profiling on any vertical milling machine. Regent R-200 has built in follower arm that insures maximum rigidity during profiling operations. 6" x 6" capacity. J. M. Kalins & Co., 1575 Railroad Ave., Bridgeport 5, Conn., or Circle No. F29.

A Lanroll Thread Rolling Attachment instruction and repair parts bulletin shows applications of attachments to automatic screw machines and turret lathes. Dimension charts of each diameter and pitch, maximum bar and hex bar sizes; penetrations for bolt, straight pipe, and taper pipe applications are given for five sizes of attachments. Bulletin I-400-2 is available from Landis Machine Co., Waynesboro, Pa., or Circle Inform-A-Gram No. F30.



M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

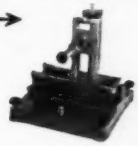
with new Gaertner Coordinate Cathetometers

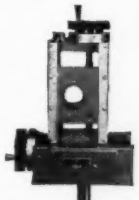
These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46— Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.





M1236-22— Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53 & 194-57

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.

Telephone: BUckingham 1-5335

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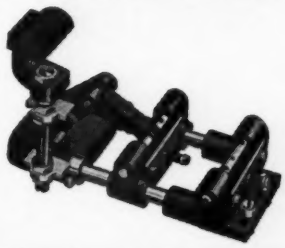
A SURE FEED



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Your pressroom can produce more with this compact, durable stock feed. Can be mounted right on die set to save you time. Direct linkage feeding affords greater accuracy. Comes in 2" and 3" sizes. Write for detailed bulletin on this cost-cutter.

THE PRODUCTO MACHINE CO.

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Bridgeport 1, Connecticut

ENCO

Self-Indexing HEXTURRET

Convert your lathes for turret work this quick, easy way. ENCO HEXTURRET gives you the *accuracy*, *rigidity* and *speed* you need to step up lathe production and cut "per piece" costs. Easy as mounting your lathe tailstock. Does both normal and heavy lathe and screw machine work, drilling, counter boring, counter sinking, spot facing, reaming, turning, boring, etc. Fit all lathes 9" to 16" swing.

Mail coupon for cat. #53 and name of nearest Enco Franchise Dealer.

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4520 W. Fullerton
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PRECISION ENCO ECONOMY

ENCO Manufacturing Co.
4520 W. Fullerton,
Chicago 39 Dept. 139

Please send catalog #53 and full details of ENCO HEXTURRETS.

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13404 St. Clair Ave. Cleveland, Ohio
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NOBLE & STANTON, INC.
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CAMS
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— Except Screw Machine Cams —
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KIDDE PRECISION TOOL CORPORATION
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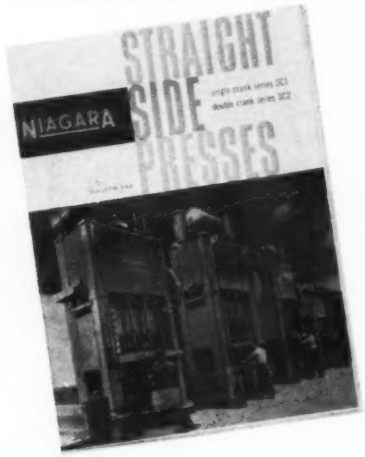
CIRCLE INFORM-A-GRAM KEY NO. 1161

Pressworking

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES

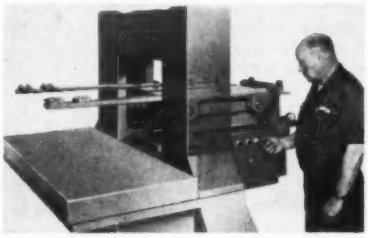
Straight-Side Crank Presses, a redesigned and expanded line from Niagara, are featured in a 44-page catalog that contains operating and structural features; charts and tabulated information concerning punch



and press speeds; and detailed specifications for 50- to 500-ton capacity presses. Get Bulletin 64 from Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, N.Y., or Circle Inform-A-Gram No. G1.

Bench and Floor Style Presses in standard, deep throat, and air-friction clutch models are highlighted in a bulletin which gives specifications on this 2- to 5-ton Juniorline Series. Get your copy from Sales Service Mfg. Co., 2365 University Ave., St. Paul 14, Minn., or Circle Inform-A-Gram No. G2.

Convert Single Action Presses into transfer feed presses with Trans-Feed. It feeds strip stock or parts in and out of die areas automatically, feeds material between

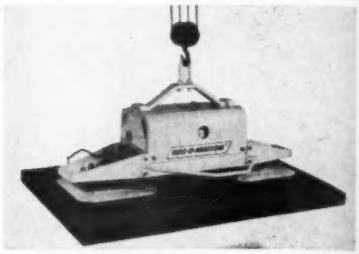


dies in press, or transfers and feeds two or more presses in a line. Press Automation Systems, Inc., 25418 Ryan Rd., Warren, Mich., or Circle Inform-A-Gram No. G3.

Fill Scratches or Scoring left on die surfaces after grinding to remove metal pick-up or galling with Die Lube Stick. It comes in crayon form and is easily applied to affected areas without removing dies Write Chemical Lubricants Co., 1402 N. Woodward Ave., Royal Oak, Mich., for information, or Circle Inform-A-Gram No. G4.

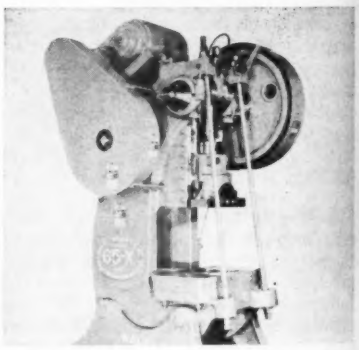
"Press Room Equipment" is a catalog which contains descriptions of friction-type roll feeds, stock straighteners, stock reels, coil cradle foot presses, and tool and die makers vises. Dimensions and illustrations are included. Get Catalog DRI-57 from Montgomery & Co., Inc., 401 Morris Ave., Springfield, N.J., or Circle Inform-A-Gram No. G5.

Lift and Move Steel and non-ferrous plates with this square cap vacuum lifter announced by Vac-U-Mation Div'n of F. J. Littell Machine Co., Dept. 4-F, 4127 N. Ravenswood Ave., Chicago 13. It has two 20" sq vacuum cups; each cup has 4,000



lbs lifting power. With a 4:1 safety factor the lifting capacity is still 1,000 lbs. Get Bulletin Air 45 from the company, or Circle Inform-A-Gram No. G6.

The New 65 X, 65-Ton Deep Throat OBI Press is available with flywheel and back gear models with up to 7" strokes. Variable speed drives, automatic or one shot grease lubrication,



and air balancing units and air cushions may be furnished. Walsh Press and Die Co., 4709 W. Kinzie St., Chicago 44, or Circle Inform-A-Gram No. G7.

Two- and Five-Ton Models of Kenco punch presses are presented in a bulletin which describes several new features and accessories. Dimensional drawings and list of dimensions for different models are included. Get this bulletin from Kenco Mfg. Co., 5211½ Telegraph Rd., Los Angeles 22, or Circle Inform-A-Gram No. G8.

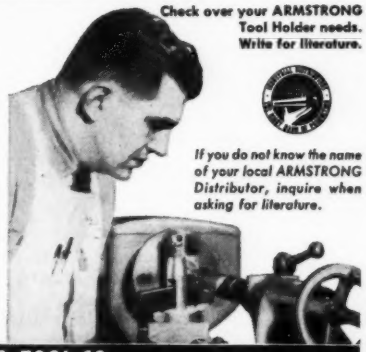
ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs. Write for literature.



If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5320 W. ARMSTRONG AVE. CHICAGO 46, ILL.

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Complete DRILLING

versatility

Is your drilling *accurate and economical* in structural steel, tube sheets, flue sheets, and other large cumbersome parts? Universal Joint Adjustable U. S. Drill Heads with Air Counterbalance and 360° Ball Bearing Swivel Attachment add versatility to radial drills.

Select the *right* head for your jobs from the many sizes of Style U Heads.

Lots of cost-reducing features: Full ball bearing mounting . . . Shaved gears . . . Exclusive quick-change neoprene-sealed universal joints . . . Heavy duty spindles . . . Adjustable-arm or special bored Slip Spindle Plates.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads. Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

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Soldered Automatically

1440 Sink Trap Assemblies Per Hour

This new G.A.S. engineered soldering unit replaces the hand torch method of soft soldering threaded collars to brass "J-bend" sink traps.

The problem presented to G.A.S. engineers was to replace a method no longer equal to competitive conditions; to improve quality; increase production; and provide a unit flexible enough to handle many sizes and styles.

G.A.S. engineered solution to the problem is shown in the cut above — a unit which will automatically flux, pre-heat, apply solder, sweat, cool and wash off excess flux and discharge "J-bend" having one or two collars per piece — actually — up to 2880 completely soldered collars per hour are possible.

Important Features

- **One-Man Operation**
- **Automatic Timer Controlled Indexing Conveyor**
- **Automatic Metered Flux Applicator**
- **Burners, Individually Adjustable**
- **Automatic Metered Wire Solder Feeder**
- **Cooling and Flux Rinsing Station**
- **Mechanical Discharge**

Advantages

- **Quality at Lower Cost**
- **Uniformity of Product**
- **Increased Production**
- **Controlled Use of Solder and Flux**
- **Straight Line Production**

This is just one example of G.A.S. ability to engineer an economical and efficient solution to a heat processing problem.

Let us analyze your heat processing requirements—a brief description is all that's required, and, of course, there is no obligation. Write today!

INDUSTRIAL GAS EQUIPMENT DIVISION — CODE OF ETHICS SIGNER — GAS APPLIANCE MANUFACTURERS ASSOCIATION — SIGNER NO. 40

GAS APPLIANCE SERVICE, INC.

Heat Process Engineers

1936 West Balmoral Avenue, Chicago 40, Illinois

Representatives in Major Industrial Areas

CIRCLE INFORM-A-GRAM KEY NO. 1173

New "Driving Center" Introduces Faster Machining Techniques on work Held Between Centers

Eliminates Chucks and Clamps... Permits Full End-to-End Machining..."Loads" or "Unloads" without Stopping

A new development to increase both output and accuracy, the Ideal Driving Center grips the end face of the work and so eliminates entirely the need for chucks, dogs or other bulky clamping devices.

New machining techniques and remarkable cost savings are thus made possible. Chucking time is completely eliminated and work may be machined from end to end without removal or change. Usually the machine can be loaded and unloaded without stopping, which substantially reduces wear on motors, belts, gears and clutches.

Quality of work is generally improved, because rigid direct-drive action reduces backlash and eliminates slippage. Precision indexing on gear hobbers and mills is simplified.

Preliminary machining is unnecessary; self-compensating pins grip and hold non-uniform work-ends — even odd-shaped pieces that cannot be held by other means.

Lathe or other machine operators do not have to learn difficult new methods. The Driving Centers are available in catalog models providing 63 combinations to fit maximum work diameters from ⅞" to 6⅜", in Morse tapers 2 to 6. Larger sizes may be had as "specials".

Complete details of operating principle and selection chart will be sent without obligation. Mail coupon below to

IDEAL INDUSTRIES, Inc.

IDEAL

IDEAL INDUSTRIES, Inc.
1334-C Park Ave., Sycamore, Ill.

Please send me complete engineering data and selection chart for IDEAL Driving Centers.

Name_____

Company_____

Address_____

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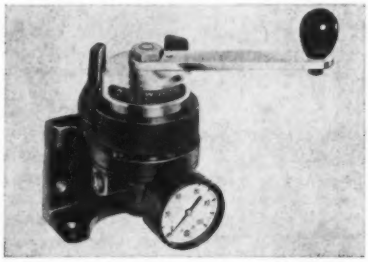
CIRCLE INFORM-A-GRAM KEY NO. 1181

Pneumatic & Hydraulics

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

Use A Remote-Fill Device for air line lubricators with standard model Crown lubricators for quick filling of lubricator bowls. Easy to service in high or hard-to-reach places. Get information from Hannifin Co., Dept. 164, Des Plaines, Ill., or Circle Inform-A-Gram No. H1.

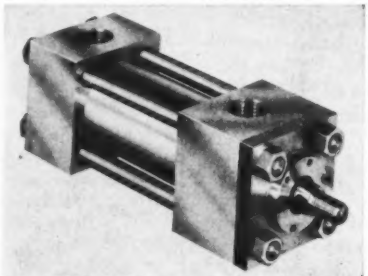
Increase or Decrease Clamping Pressure during machining cycle to control distortion with the new model differential air control used with Woodworth diaphragm chucks and air-operated Tork-Lok arbors. Two



preselected pressures are used; one operates the air device as for loading, and the other regulates air released when clamping. N. A. Woodworth Co., 512 Free Press Bldg., Detroit 26, or Circle Inform-A-Gram No. H2.

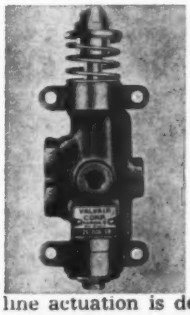
Space Saving Hydraulic Cylinders with 2,000 to 3,000 psi operating pressures and 1½" to 12" bore sizes, are outlined in a bulletin. Detailed diagrams illustrate mounting instructions, and Series H engineering data is included. Get Bulletin H-100 from Milwaukee Cylinder Co., 5757 S. Pennsylvania Ave., Cudahy 7, Wis., or Circle Inform-A-Gram No. H3.

Hydraulic Cylinders for up to 2000 psi operation are available in bore sizes from 1½" to 8". Series TH has heavy-duty heads that pilot on bore of tube and confine OD to



prevent breathing and reduce leakage. Bulletin 105 from Ortman-Miller Machine Co., 19 143rd St., Hammond, Ind., gives dimensions, or Circle Inform-A-Gram No. H4.

A New Hydraulic Fabrication Technique is fully described in a bulletin which tells how the process utilizes standard building block components, subplates with pressure, return, and drainless lines manifolded within the block. A comparison of panel systems and a diagram of the Petch layout is included. Contact Petch Mfg. Co., 463 York, Detroit 2, for your copy of Bulletin H-58, or Circle Inform-A-Gram No. H5.



This New Ball Cam - Actuated Manual Valve is designed for operation by any mechanism having linear motion. Use it on press controls, with air cylinders, or similar applications where straight line actuation is desired. It features 3/4" dia hardened stainless steel ball, spun-locked in a stainless steel retainer. Valvair Corp., 454 Morgan Ave., Akron 11, Ohio, supplies literature, or Circle No. H6.

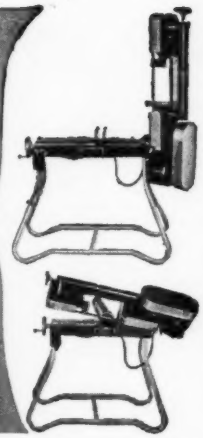
An Air Motor Bulletin features over 100 popular air motors in the I-R line. Units cover a power range from 0.3 to 24 hp, with speeds running from 50 to 2580 rpm at rated hp. Specifications and dimensional drawings are given for both multi-vane and piston motors. Get Bulletin 5072A from Ingersoll-Rand, 11 Broadway, New York 4, or Circle Inform-A-Gram No. H7.

A New Relieving-Type Air Line Regulator features built-in pressure relief valve and adjusts pressure by turning in one plane of rotation. They reduce primary line operating pressures of up to 250 psi and ¼" to ⅜" models are available from The Bellows Co., Akron 9, Ohio, or Circle Inform-A-Gram No. H8.

Advantages of Square Design Cylinders and comparisons of mounting space required for bore square types and similar bore sizes of threaded or keeper ring types, are discussed in a bulletin. For details get a copy from Miller Fluid Power Div'n, Flick-Reedy Corp., 2040 N. Hawthorne Ave., Melrose Park, Ill., or Circle Inform-A-Gram No. H9.

SAWS for the PRICE of

...use the WELLS 49A for Horizontal Cut-off and Vertical Band Sawing



The Wells 49A is a dual-purpose machine designed for shop or "job-site" work. As a horizontal cut-off saw, the 49A has a capacity of 3½" x 6". Swing the head to vertical position . . . it's an upright band saw. No tools required! Use it for cutting angles, slots, notches, bevels and light contour work.

The 49A can save time and money for you. Let your local Wells Distributor show you how . . . or write direct for complete information.

Wells

The Pioneers of Horizontal

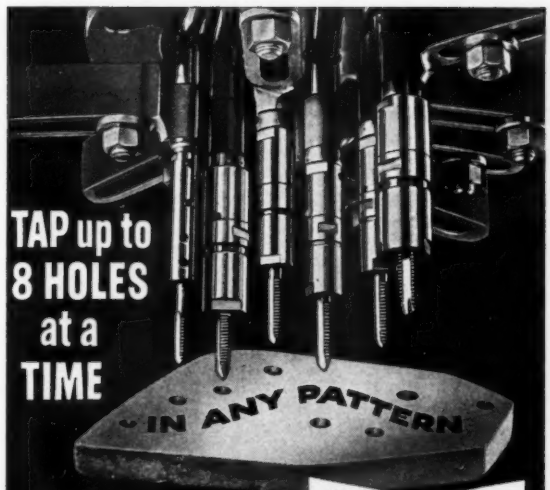
METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 CEDAR ST., THREE RIVERS, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1191

TAP up to 8 HOLES at a TIME

IN ANY PATTERN

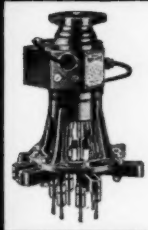


with a **MULTI-TAPPER**

★ AUTOMATIC TAP REVERSAL
★ FITS ANY DRILL PRESS
★ PRECISE DEPTH CONTROL

MULTI-TAPPER simultaneously handles different tap sizes and pitches—can be set up for automatic or semi-automatic operation. Makes any drill press a production tapping tool.

Want a demonstration in your plant? Write us and we'll arrange it with your nearby Commander Distributor. Ask for your copy of the new Commander Production Tool Catalog.



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VAPOR-LUB COOLING

Precise

REFRIGERATES FOR FASTER WORK—LONGER TOOL LIFE

Unlike liquid coolant systems, VAPOR-LUB refrigerates and lubricates entire cutting area for maximum efficiency. By sudden expansion of compressed air through a precision nozzle, temperatures are reduced in cutting area up to 20 F below ambient. In addition, an atomized coolant spray is deposited on tool and work to lubricate and reduce frictional heat. VAPOR-LUB is clean, simple, and economical—requires no special plumbing or coolant pans. Available with single or multiple jet nozzles. Single nozzle units, $47.50 complete; two nozzle units, $69.50. Send for FREE information.

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Power Quills Grinder Millers Milling Machines Accessories Cutting Tools Vapor-Lub Cooling Systems
Quality and Precision Since 1882

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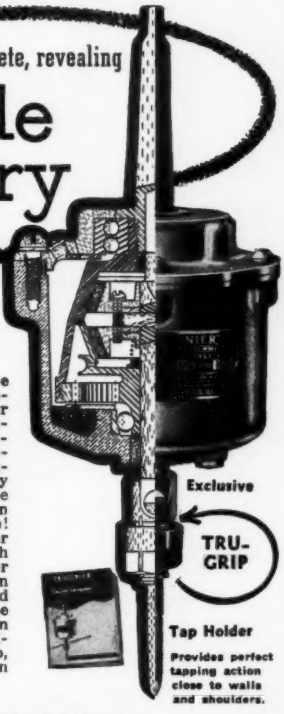
Get the complete, revealing

Inside Story

on the finest tapping heads ever made!

A complete feature by feature analysis on the amazing Procunier Tapping Line is yours for the asking! Gives a true "peep-hole" story on the many outstanding construction improvements, the mechanical advancements and precision quality operating advantages that make Procunier heads a "must" in production plants everywhere! You'll learn why Procunier means more tapping hours with minimum "down-time", faster production with fewer broken taps, fewer spoiled pieces and a "new-found" operating ease that helps operators maintain stepped-up production schedules. Find out how you, too, can benefit with Procunier in your plant.



Exclusive
TRU-GRIP
Tap Holder
Provides perfect tapping action close to walls and shoulders.

Write for FREE Brochure!

PROCUNIER SAFETY CHUCK COMPANY
12-14 S. CLINTON ST., DEPT. 3 CHICAGO 6, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1194

FOR PRODUCTION ECONOMY . . . FORD TOOLS CUT FASTER, BETTER, LONGER

CARBIDE TOOLS
- HI-ROC DRILLS
- REAMERS
- END MILLS
- CUTTERS
- SPIRAL FLUTE DRILLS
- BORING TOOLS

H.S.S. TOOLS
- CUTTERS
- COUNTERSINKS

H.S.S. and SOLID CARBIDE Ford tools present the economical answer to long-run production problems. By maintaining cutting edges longer, resharpening time is reduced. Tool replacements are minimized.

Ford precision tool design cuts part reject rate, too.

With a full range of sizes, Ford tools are available for all production cutting and drilling jobs.

Factual testimonials from industrial users substantiate their lasting precision quality and steady economy. Your shop, too, can benefit from the production advantages of Ford H.S.S. and SOLID CARBIDE machine tools. Available through all Ford industrial distributors.

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Rotary FORD Tools

M. A. FORD MFG. CO., INC.

1545 Rockingham Rd., Davenport, Iowa

Manufacturers of Precision Machine Tools

CIRCLE INFORM-A-GRAM KEY NO. 1201

NEW AIR JET HAND GRINDER

(Reproduced here ⅞ actual size)

75,000 R.P.M.

with *NEW* PUSH BUTTON STOP BRAKE and *NEW* SPEED REGULATOR for rotary files and burrs.

- Wt.—16 oz.
- Air pressure 70-100 lb.
- ⅛" Chuck
- Up to ⅞" wheel diameter.

WILL SHIP ON 10 DAYS TRIAL!

Write for brochure and prices.

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Are you asking him to control a precision machine without a precision gage?

Give him **COMPLETE KNOWLEDGE!**

1. exact size shown readable to fraction of .0001". (a fixed — not passing reading.)
2. front or back taper, exact amount of.
3. ovality, exact amount of diameter variation.
4. bell mouth or barrel shape, exact amount of lateral irregularity.

Self-centering and self-aligning Comtorplug assures precise gaging, easily and simply, independent of operator variations. For holes from ⅛" to 10" diameter.

for holes ⅛" to 10" diameter

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Chicago Pneu. Tool	Hamilton Standard Division	Pontiac Motor Div.
Chrysler Corp.	Harris Seybold Co.	Scintilla Magneto
Continental Motors	Homelite Corp.	Steel Products Eng.
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Douglas Aircraft		Warner Gear Div.

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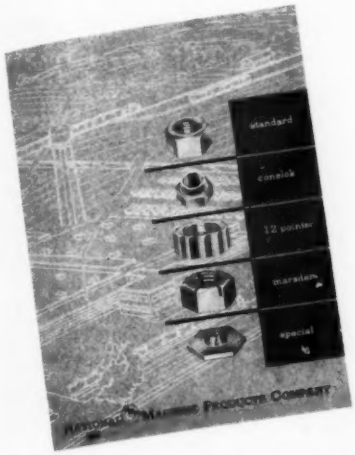
COMTOR CO., 82 FARWELL ST., WALTHAM 54, MASS.

COMTORPLUG

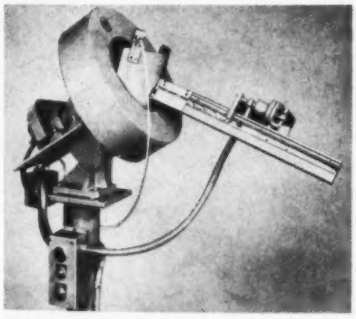
CIRCLE INFORM-A-GRAM KEY NO. 1203

Engineering Data and specifications are given in a bulletin for hexagon nuts from ¼" to 3"; 12 pointer to ⅝"; and Conelok, Huglok, and Marsden locknuts from ¼" to 1½". Request your copy from National Machine Products Co., Utica, Mich., or Circle Inform-A-Gram No. J1.



A Hex-Socket Screw Handbook is a pocket-sized booklet containing 112 pages of dimentional standards thread lengths, torques, finishes, and hardness conversion information for socket head cap screws, flat head cap screws, shoulder screws, hex key and dowel pins. This handy guide Booklet G-23, is available from The Allen Mfg. Co., Hartford 2, Conn., or Circle Inform-A-Gram No. J2.

A Low Cost Rotary Hopper orientates 20,000 parts/hr and performs work on the feed track to help eliminate jamming. Ruggedly constructed, the unit features a stand-



ard gear-head motor, cast iron frame and hardened working parts. Get information from Radio Corp. of America, Industrial Automation Equipment, 13541 Auburn Ave., Detroit 23, or Circle Inform-A-Gram No. J3.

High Tensile Electrodes are covered in a bulletin which presents operating characteristics, physical properties and markings, and current ranges of Jetweld LH-90 and LH-110. Features are also given in Bulletin 7205.1, available from The Lincoln Electric Co., Cleveland 17, or Circle Inform-A-Gram No. J4.

Put Load-Bearing Threads into thin metal quickly and economically with the new self-swaging clinch-type nut, introduced in a bulletin. About 50% of the usually required pressure is needed for installing this type fastener in steel, brass, monel, and aluminum. Get a Swage Nut Catalog from Standard Pressed Steel Co., Jenkintown, Pa., or Circle Inform-A-Gram No. J5.

A New Tool Catalog contains 34 pages of descriptions, detailed drawings and dimensions for numerous fasteners. Now included are new rivet sets to drive stainless steel and harder Hi-Shear material collars. Very short rivet sets for use with stubby Jiffy guns are also included. This 9th edition is available from Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif., or Circle Inform-A-Gram No. J6.

Assembly

PRODUCTS & PROCESSES & PRODUCTS

Insert and Power Bits for production screwdriving are subject of an 8-page catalog which gives a description of their features and lists dimensions for the different types. Write to Zephyr Mfg. Co., Inc., 201 Hindry Ave., Inglewood, Calif., for a copy of Catalog 12C, or Circle Inform-A-Gram No. J7.

Above
No. 55 Flywheel type—
56-ton capacity
Also available
No. 44—43-ton capacity
No. 33—27-ton capacity

The
FEDERAL
"55"
gives you

OVERSIZE DIMENSIONS

Eliminates the need for larger and more costly equipment! Boosts production on big and bulky jobs!

Here's a press that will handle big, bulky jobs ordinarily requiring larger, more expensive equipment. Equipped with foolproof air clutch, its speed is increased many times, safely and with better control. Only the finest components are used in the "55". Workmanship, as in all Federal Presses, is unexcelled. Flywheel or geared types. Mechanical clutch standard. Call your dealer. Write for catalog.

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33 Years of Quality Construction

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They're now available from stock in new standard 18" lengths!

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LONGBOY DRILLS

Been buying costly "specials" for deep hole drilling operations? Then you'll be glad to know that Ace Longboy Drills are now available from stock in a wide range of standard sizes and in both 12" and 18" lengths! What's more, their polished flutes are precision ground in top quality pre-hardened high speed steel to provide a finer finish, keener cutting edges, and longer drill life.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

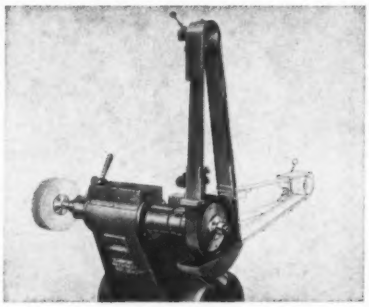
CIRCLE INFORM-A-GRAM KEY NO. 1221

Grinding & Finishing

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

Handle Complicated Wheel Dressing Problems with the new line of diamond dressing tools from EDCO Tool Co., 93 Oak St., Wyandotte, Mich. A bulletin lists types and styles of single point dressers, Faceset dressers, Edgeset dressers, Layerset dressers, and thread grinding dressers. Write to the company for a copy of Catalog 1258, or Circle Inform-A-Gram No. K1.

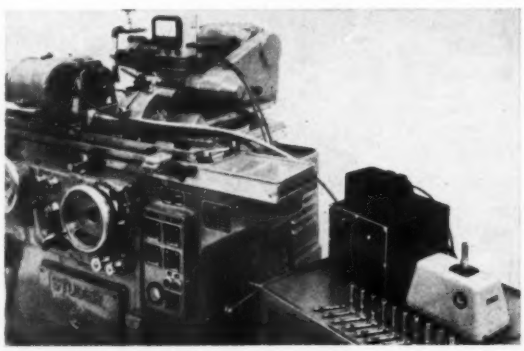
Economically Polish and Buff on one machine with the new UP-2 abrasive belt polishing head from Hammond Machinery Builders, Kalamazoo, Mich. Use on Hammond OK, RL, and ROL polishing lathes for



light- to medium-duty polishing. Spindle speed of 1750 rpm gives 5500 sfpm using a 12" dia contact wheel. Get details from company, or Circle Inform-A-Gram No. K2.

A Vibratory Lapping-Polishing Machine for easy mechanical polishing of metallurgical samples for inspection, is described in a bulletin. Explanation of method used and specifications of machines are given. Get copy from Syntron Co., 341 Lexington Ave., Homer City, Pa., or Circle Inform-A-Gram No. K3.

Diamond Wheels made by Pressurelok method are in a catalog with descriptions of different wheel types and their uses. Diagrams show wheel shapes. Tips on how to order wheels for specific needs are also given. Get Catalog 957 from United States Diamond Wheel Co., 835 Illinois Ave., Aurora, Ill., or Circle No. K4.

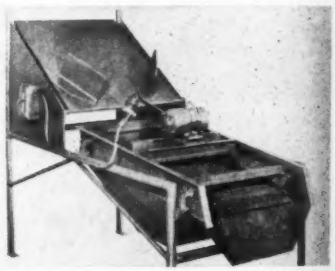


Grinding or Cutting where ¼" shank-mounted wheels or cutters can be used, is possible with Imp Model 7979 turbine grinder. Air system blows chips and particles away

from the work, keeping working area clean. Get information from The Aro Equipment Corp., Bryan, Ohio, or Circle Inform-A-Gram No. K5.

A New Modern Grinding Dresser runs on a resilient bushing and will shape and sharpen wheels and discs from ¼" to 20" dia. Model 514's fast cutting action permits shaping wheels to various contours, with only light pressure required. Thompson Sales Co., 116 W. 12 St., Erie, Pa., or Circle No. K6.

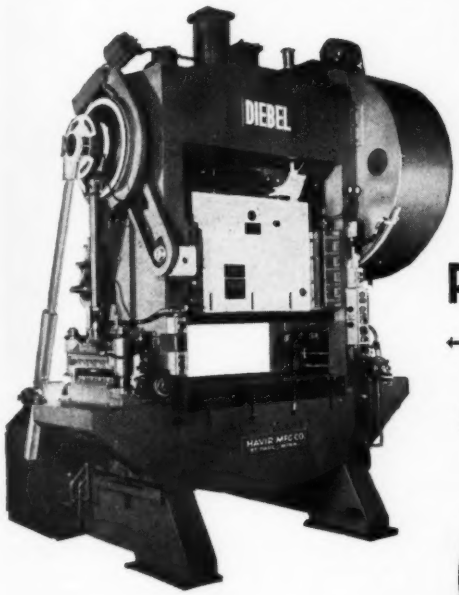
This Vibrating Separator uses a new principle to screen and separate a wide size and shape of processed parts and barrel finishing abrasive media. Larger bed, with 18" x



48" screening surface, makes this possible. Write Roto Finish Co., Kalamazoo, Mich., for details, or Circle Inform-A-Gram No. K7.

This New High-Precision Universal Grinding Machine is hydraulically controlled and equipped with special electronic measuring controls. Designed for match-grinding, internal and external grinding, and superfine and lap grinding, Studer RHU-450 handles workpieces up to 18". Get details from Cosa Corp., 405 Lexington Ave., New York 17, or Circle No. K8.

Now... DIEBEL HI-PRODUCTION AUTOMATIC PRESSES Join PRESS-RITE Open Back Inclinable POWER PRESSES



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(Sizes 5 to 150 ton)

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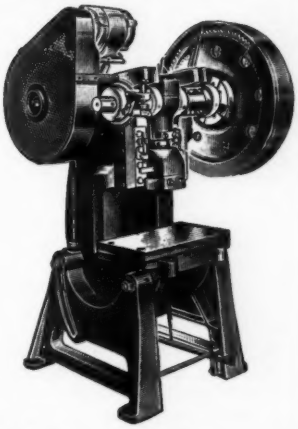
(Sizes 2 to 85 Ton) ↓



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BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
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MINIATURE DRILL BUSHINGS
Hole Sizes—No. 80 to 3/32"
O.D. 3/32" to 13/64"
Lengths ¼" to 3"
.0002 Tolerance on I.D.
O.D., and Concentricity
Specials to your specifications
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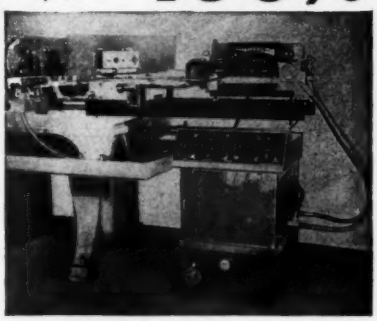

. . . and makes a hand operated turret lathe dependably automatic.

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Grinding & Finishing

PROCESSES & PRODUCTS & PROCESSES

Use This Safe and Fast Angle Dresser in tool and cutter grinding, and cylindrical and surface grinding.

Dressing action obtained by rocking between centers. Small and handy, it can be left on the machine, but is out of the way of the grinding wheel. Get details from The Steptool Corp., 3613 E. Olympic Blvd., Los Angeles, or Circle Inform-A-Gram No. K9.

For Small Parts Deburring and Precision Cleaning, use the Liquamatte tumbling barrel, described in a bulletin. Complete operating instructions, as well as mechanical and operating specifications, are given. Get Bulletin 103 from Techline Div'n, Wheelabrator Corp., 1183 Avenue V., Vicksburg, Mich., or Circle Inform-A-Gram No. K10.

PUSH BUTTON *Speed Selection*

from **to** **in seconds**

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* **PRECISION LATHES**

Illustrated WM56P
13" Swing- 34" Centers
Base Price F.O.B. Factory
$2146.00
Less Chip Pan and Electricals
Also available with 11" Swing

Write for
"Variable Speed" Circular and General Catalog showing . . .

- 10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)
- 13" and 15" SEBASTIAN Geared Head Lathes
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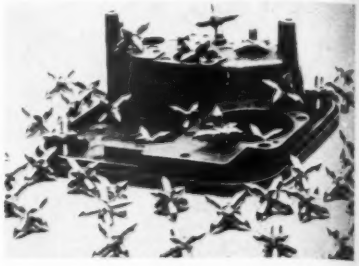
CIRCLE INFORM-A-GRAM KEY NO. 124

A New Tumbling Media, Zinc Multi-Stars, is for precision barrel finishing of intricate castings with odd shaped holes or recesses. This die cast media has shock absorbing



characteristics. Each one measures 1¼" from point to point. BMT Mfg. Corp., 110-112 E. 9th St., Elmira Heights, N.Y., or Circle Inform-A-Gram No. K11.

New Handee Grinder and Accessories Catalog gives information on the G & F hand grinder—its uses and operations, and applications. Dimensions for mounted wheels, saws, and cutters are included. Get Catalog 6065 from Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Chicago, or Circle Inform-A-Gram No. K12.

Automatic Tube Expander Drives for uniform tube expanding are presented in a bulletin from Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N.Y. Operating features of Torq-Air-Matics and dimensions for three models are given. Company supplies copies of Bulletin 581, or Circle No. K13.

Get up to 25% Greater Operating Safety with spitfire aluminum oxide grinding discs announced by Abrasives Products, Inc., S. Braintree 85, Mass. They feature reinfor-

ced edges and sharp, uniform cutting action. Made in grit sizes from 16 to 180. Get a folder from company, or Circle Inform-A-Gram No. K14.

Two Methods for manufacturing ultra precision grinding wheels for toolrooms, and for grinding crankshafts and camshafts, are explained in the publication, "Cutting Trends." Write to Simonds Worden White, 1101 Negley Pl., Dayton 7, Ohio, for a copy of Vol. 1, No. 2, or Circle Inform-A-Gram No. K15.

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JOHANSSON RADIAL DRILLING MACHINE

AMERICA'S MOST OUTSTANDING MACHINE TOOL

GEAR DRIVE — 1¾" CAPACITY — SPEEDS 60-2000 RPM

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JOHANSSON MACHINE TOOLS

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USE THIS NEW KIND OF DIAMOND CUT-OFF WHEEL

Gives narrower, smoother cuts on industry's toughest materials

. . . yet prices start at only $32.25

Now . . . at *production prices* . . . DIATRONIC gives you a rim width of .006" that's accurate to a maximum total tolerance of .0005"—or your money back. This accuracy is built in by a new process. No break-in needed. New narrow cut reduces sawdust loss 30%. A must for $3,000-a-pound silicon or germanium crystal. Cuts tungsten carbide, corundum, aluminum oxide, glass . . . practically anything. Stock orders shipped in hours; special wheels available. Write for literature, price list.

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DIATRONIC* DIAMOND WHEELS
"with built-in tolerance" *TRADEMARK

CIRCLE INFORM-A-GRAM KEY NO. 1252

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TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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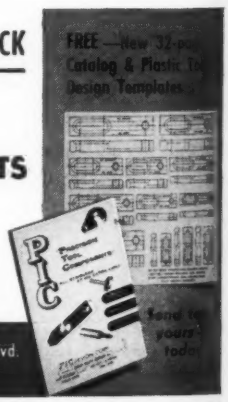

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0000	160
000	120
00	90-96-112
0	56-64-72-76-80
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80
3	36-40-60-64-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-48-64
8	24-26-28-30-38-40-44-48-56-60-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-36-40-48-56-60-64-72-80
11	20-22-24-28-30-32-36
12	20-22-26-27-30-32-36-38-40-48-56-60-64-72-80
13	20-22-24-28-32
14	14-16-18-26-28-30-32-36-40
15	18-20-24-28-32
16	16-18-20-22-24-28-32-36
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18	16-18-20-24-32-40
19	18-20
20	14-16-18-20-24-32
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24	14-16-18-22-24
26	14-16-20-24
28	14-16-20
30	14-16-20
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11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-27-28-30-32-36-40-48-56-64-72
.198	24

SIZE	THREADS PER INCH
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-22-24-28-36-40
1/4	10-12-14-16-18-22-23-24-25-26-27-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32
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27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-48-56
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15/32	12-14-20-24-27-28-32-40
1/2	10-11-12-14-16-18-22-24-26-27-28-30-32-36-40-48-56
33/64	12-13-20-24
17/32	10-12-13-14-16-18-20-24-27-28-32-40
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9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48
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19/32	12-18-20-24-28-32-36-40
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-56

SIZE	THREADS PER INCH
41/64	11-18-24
21/32	10-11-18-20-24-27-32-40
11/16	10-11-12-14-16-18-20-22-24-27-28-30-32-36-40
23/32	11-12-16-18-20-27-32-36-40
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29/32	9-12-14-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-27-28-32-40
31/32	9-12-16-18-20-24-28-32
1	5-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1-1/32	8-12-14-16-18-20
1-3/64	14
1-1/16	8-10-12-14-16-17-18-20-24-27-28-32-40
1-3/32	7-8-9-12-14-16-18-20-32
1-1/8	8-10-14-16-18-20-24-27-28-32-40
1-5/32	7-8-9-12-14-16-18-20-24-32
1-11/64	18
1-3/16	7-8-10-12-14-16-18-20-24-32-40
1-1/4	8-10-14-16-18-20-24-27-28-32-40
1-5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40-48
1-3/8	5-8-10-14-16-18-20-24-32-40
1-13/32	20
1-7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-18
1-9/16	6-8-10-12-14-16-18-20-24-32-40
1-5/8	5-5½-6-8-10-11½-12-13-14-16-18-20-24-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5
1-3/4	5-6-8-10-12-13-14-16-18-20-24-28-32-40
1.767	18
1.7715	12
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	18-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-28-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	8-10-12-14-16-18-20-24
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2-5/16	8-10-12-14-16-18-20-24
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2-7/8	4-8-10-12-14-16-18-20-24-32
2-15/16	8-10-12-14-16-18-20-32
3	3½-4-8-10-12-14-16-18-20
3-1/8	4-8-10-12-14-16-20
3-3/16	4-8-10-12-14-16-20
3-1/4	4-8-10-11-12-14-16-18-20
3-3/8	4-8-10-12-16
3-1/2	4-8-10-12-16
3-3/4	4-8-10-12-16
4	4-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

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SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

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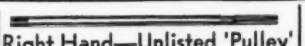
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus	.003, .005, .010 .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NF		
1	56 NS	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
9/16	12 NC, 18 NF	1-1/8	7 NC, 12 NF
5/8	11 NC, 18 NF	1-1/4	7 NC, 12 NF
11/16	11 NS, 16 NS	1-3/8	6 NC, 12 NF
3/4	10 NC, 16 NF	1-1/2	6 NC, 12 NF



Right Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24 NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
1/4	28 NF	3/4	16NF
5/16	24 NF	Also Larger Sizes	NC & NF

UNLISTED Right Hand "Pipe" Taps

"NPT" Taper Size	"NPT" Thread	"NPS" Size	"NPS" Thread	EX. LENGTHS "NPT" & "NPS" Size	EX. LENGTHS "NPT" & "NPS" Thread
1/16	27	1/16	27	1/16	27
1/4	27	1	8	1/8	27
2-1/2	8	1-1/4	11½	1/4	18
3	8	1-1/2	11½	3/8	18
3-1/2	8	2	11½	1/2	14
4	8	2-1/2	8	3/4	14
Also British		3	8	1	11½
		3-1/2	8	Also British	
		4	8		
		Also British			

Lefthand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
1/2	14	2-1/2	8
3/4	14	3	8
Also British		Also British	

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(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machine stopped for release of tap.
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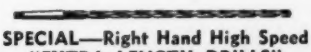

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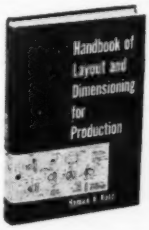

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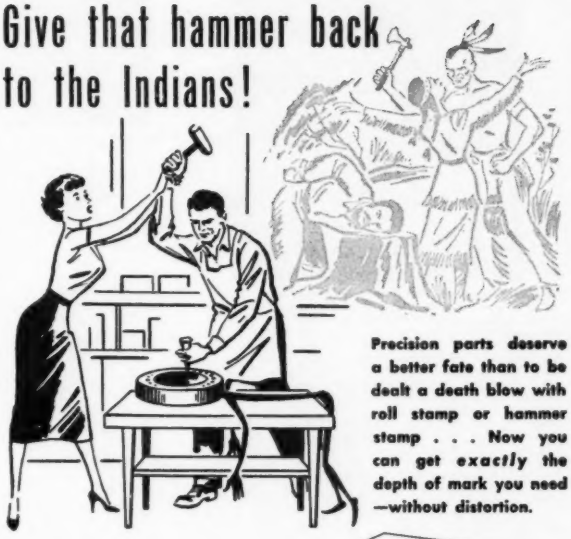

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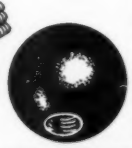

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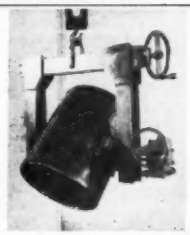

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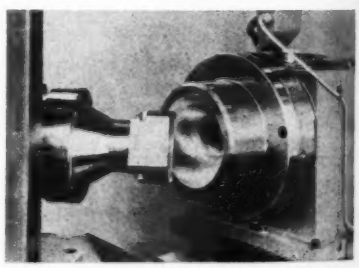

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